Coordination in Norwegian Wage Setting

Estimation of wage relations with heterogeneous labour

Kristine Wika Haraldsen

Master of Philosophy in Economics

Department of Economics

University of Oslo

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Kristine Wika Haraldsen

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Haraldsen, Kristine Wika

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Any errors and inaccuracies in the thesis are my responsibility.

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1 Introduction and summary

In a perfect competitive market, wages are determined in the intersection between supply of and demand for labour. There are many equal firms and many equal workers, and none of the agents can affect the wage level by their actions. Wages are equal to the marginal productivity of labour in production. However, labour markets are almost never characterised as a perfect competitive market, and wages will normally divert from the competitive market solution.

The Norwegian system is characterised by pattern wage bargaining. The sector exposed to international competition negotiates first and is considered to be a wage leader, while the private services and the public sector follow the wage norm. This implies that organisations in the manufacturing sector negotiate first, and that the wage settlements in this sector is the wage norm of the following negotiations in private and public sector. The manufacturing sector adjust wages towards an equilibrium wage share, and the other sectors use the manufacturing wage as a reference wage. In this way coordination is inherent in the Norwegian system.

The Norwegian system for collective wage bargaining is a tripartite cooperation between trade unions, employer organisations and the government that ensures coordination between the parties. The wage setters face a trade off between wages and employment which moderate their wage claims. And the government seeks low unemployment to ensure production and tax income, amongst other reasons. According to Calmfors and Driffill (1988), the wage outcome will move towards the perfect competitive market solution if the degree of coordination in the wage settlements is sufficiently high.

The first aim of this thesis is to estimate wage relations using data from 1972 to 2012 to investigate Norwegian wage setting. The starting point for the estimation is the wage relations by Bjørnstad and Skjerpen (2006), as their relations are currently used in Statistics Norway's large macroeconomic model, ADMOD. This is a version of MODAG with heterogenous labour, see Boug and Dyvi (2008). Their wage relations were constructed using data from 1972 to 1997, and they are estimated disaggregated by five educational groups. The basis for the wage equations is the theory of the Norwegian system of wage setting by Bårdsen et al. (2005).

Much have changed in the Norwegian economy since 1997, including the introduction of inflation targeting in 2001 and a surge in immigration since 2004. Following Bjørnstad et al. (2002), immigration may change the size and bargaining power of the different educational groups, and according to Larsson Seim and Zetterberg (2013) the introduction of inflation targeting may have

affected the system of wage leader and wage followers. It is likely that these changes may have different effects across educational groups. The question to be answered is whether the wage relations for the five educational groups have changed over time.

The second aim of this thesis is to investigate the effect of coordination in wage settlements on hourly wages in Norway, and to see if the effect differs among educational groups. As argued, it is essential to take coordination into account when modelling wage setting. Coordination is inherent in the wage equations in Bjørnstad and Skjerpen (2006) as the long-run equilibrium is modelled as error correction-terms. The variables ensure that the wages in the manufacturing sector adjusts towards an average wage share and that the wages in the other sectors follow the manufacturing wage, hence it is pattern wage bargaining. In Bjørnstad and Skjerpen (2006) it is assumed that the wages of the lowest educational groups in the manufacturing sector are set in relatively coordinated negotiations, while the wage setting among the highest educational groups in the sector is more decentralised, but they do not test this hypothesis. The question to be answered is how coordination may affect hourly wages and whether the effect differ across educational groups.

However, error-correction is only one element of coordination. There exist several measures of coordination or centralisation in wage settlements, and the most used measures are presented in Kenworthy (2000). Coordination and centralisation may be regarded as two tools of achieving the same goal, as they are likely to pick up the same mechanism in an empirical specification. However, it can be argued that centralisation is only one element of wage coordination, and that a good measure of coordination will also pick up changes in centralisation. There are some weaknesses associated with many of these indicators of coordination used across countries. First, there is a measurement problem associated with ranking coordination of wage settlements across countries as it includes an element of subjective judgement. Second, the measures are aggregated to a level which does not capture the variation in coordination over time within a country. Third, it is impossible to condition on all factors that differ between countries, so it is difficult to capture the true effects of coordination, when comparing across countries.

To overcome these problems, a coordination index based on previous work by Barkbu (2000) is developed with more objective measures of the yearly variation in coordination in Norwegian wage settlements. The index captures the variation in the degree of coordination between and within unions and employer organisations. It captures vertical coordination as unions or employer organisations coordinate between the firm, sector and national level. And it captures horizontal coordination as unions or employer organisations coordinate with other unions or employer organi-

sations, and as unions and employer organisations coordinate.

To investigate the effects of coordination, this coordination index is added to the empirical analysis. The coordination index in Barkbu (2000) accounts for yearly changes in coordination from 1960 to 1999, and this index is developed and extended for the years 1990 to 2012 for this analysis. The index contains detailed studies of yearly wage bargaining in Norway, where five indicators of wage coordination are quantified from qualitative information based on the reports from the Technical Reporting Committee on Income Settlements (TBU). The indicators describe the organisation of the wage settlements, the degree of government contributions, the degree of coordination between unions, the degree of coordination between employer organisations, and the bargaining climate between unions and employer organisations. By allowing for heterogenous labour, with five educational groups, the effect of coordination on wages can be investigated for the different groups.

Three main conclusions will be the result of this analysis. The first is that error-correction towards the equilibrium wage share or reference wage seems to be somewhat faster than previously reported for all groups except workers with high university education in manufacturing. The second is that coordination affects hourly wages negatively, and the total effect differ across educational groups. The third is that when looking at the cross-group effects, the group of workers with high university education differ from the other educational groups in several respects. This indicates that wage growth for workers with high university education is determined differently than for other groups, which may have implications for the bargaining power of this group and for the degree of coordination in Norwegian wage formation.

The thesis is organised as follows: Section 2 is a presentation of some of the previous literature on coordination and wage setting. In section 3, relevant theory of modelling the Norwegian labour market, heterogenous labour and wage setting with coordination, is presented to provide a foundation for further analysis. Section 4 presents the Norwegian coordination index used in this study and compares this index to other indicators of coordination. Section 5 presents time series for wages, unemployment and other labour market variables in Norway over the estimation period. Section 6 reviews some empirical issues[1], before the estimation results are discussed in section 7. Section 8 concludes.

[1]Methods used are fixed effects analysis (FE) and seemingly unrelated regression (SUR). The estimations are conducted in Stata, and Oxmetrics is used to detect large outliers.

2 Literature

This section reviews previous literature relevant for further analysis. The previous literature gives insight to the effects of coordination in wage formation, the disaggregated effects on educational groups and sectors, and how monetary policy may affect the degree of coordination.

In Kenworthy (2001), Norwegian wage settlements vary between the top values of four and five on the coordination scale, depending on whether it is main or intermediate settlements. Different measures of coordination, Kenworthy (2001) and Visser (2011) among others, are presented and discussed in chapter 4.3, and all of them show that the wage settlements in Norway are characterised by a high degree of coordination.

2.1 The effects of coordination on wages

Previous literature gives insight to effects of coordination in wage settlements. The theory by Calmfors and Driffill (1988), supported by empirical evidence, investigate how macroeconomic performance is affected by the extent of centralisation of wage bargaining. Centralisation is defined as the extent of inter-union and inter-employer cooperation in wage bargaining. Decentralized wage setting is mainly conducted at the level of individual firms, whereas centralized bargaining is conducted between national trade unions and employer organisations. Data on 17 OECD countries is used to find that both a high degree of centralisation and a high degree of decentralisation are conductive to real wage restraint, while intermediate levels of centralisation are harmful. This gives a hump-shaped relation between centralisation and real wages, and hence between centralisation and unemployment.

However, coordination in wage settlements can affect different aspects related to wage setting, and wage dispersion is one of these. Barth and Moene (2013) find that coordination in wage bargaining compresses wages and reduces non-competitive wage differentials. They use the coordination index by Visser (2011) and look at average coordination over the last ten years for 23 countries from 1980 to 2009.

Kenworthy (2000) find similar results and shows that a high degree of coordination in wage bargaining leads to a compressed wage structure and reduces wage differentials. The study investigates the effects of corporatism on macroeconomic performance, income distribution and redistribution, and finds that coordinated wage setting seems to be associated with low inflation and wage restraints, especially in the 1980‘s.

2.2 The effect of coordination on wages disaggregated

Bjørnstad and Skjerpen (2006) estimate wage relations for five educational groups where pattern wage bargaining is incorporated. Coordination is incorporated by a wage share-term in manufacturing and a reference wage-term in the public sector and in private services. The assumptions in this analysis imply that coordination is less important for workers with high education, which is defined as 13 years of education or more, than for workers with less education. This is presented as an institutional difference in wage setting, and it is claimed that this has increased labour mismatch in Norway.

Bjørnstad and Skjerpen (2006) use the wage relations to investigate the effect of trade and inequality on wages and unemployment. The study finds that lower import prices has increased skill mismatch and decreased wage differentials in Norway. The first finding is that unemployment has increased among workers with low education and decreased among those with high education. The second is that wage differentials has decreased because reduction in prices has a stronger effect on the wages of high-educated workers than on workers with less education due to differences in wage setting. According to the study, the overall degree of coordination in Norwegian wage setting is high, and this has been extremely efficient in counteracting terms-of-trade shocks. This is visualised by a stronger reduction in wages in the sheltered sectors than in the manufacturing sector. The study find strong support for the notion that the manufacturing sector is the wage leader for the other sectors. In line with the assumptions, the results show some differences in wage setting across educational groups. General unemployment is found to strongly influence negotiations involving the three lowest educational groups, while education-specific unemployment influence those in the highest group. This implies that increased general unemployment will increase wage differentials, while higher education-specific unemployment among the highest group will reduce wage differentials.

The article by Bjørnstad and Skjerpen (2006) builds on previous work by Bjørnstad et al. (2002) where the authors investigate how the composition of the labour force will influence wage dispersion and unemployment. Data from 1972 to 1997 is used to look at labour supply, unemployment rates and education premium for five educational groups, and they simulate the development to 2010 for different changes in the Norwegian economy. The equations estimated in this study builds on the wage relations used by Bjørnstad and Skjerpen (2006). The wage equations are education-specific for five educational groups, sector-specific for three sectors, and they are on error-correction-form to incorporate pattern wage bargaining.

2.3 The effects of monetary policy and immigration on coordination

The degree of coordination in wage settlements depends on more than what is captured by the error correction form in Bjørnstad et al. (2002) and Bjørnstad and Skjerpen (2006).

A detailed study of the effects of immigration on wage growth is conducted by Bratsberg and Raaum (2012). Evidence that immigration has reduced wage earnings in sectors with raising immigrant employment shares, is presented. Individual panel data from 1998 to 2005 on Norwegian payroll records, is used to show that a 10 percent increase in immigration is predicted to reduce wages by 0,6 percent. One explanation is that increased immigration may lower the trade unions bargaining power.

Holden (2005) uses a theoretical model to investigate to what extents monetary regime may affect equilibrium unemployment when allowing for coordination in wage setting. The key argument is that wage setters have an incentive to coordinate as long as the price of deviating from the agreement is high enough. This is because they can achieve a good equilibrium with moderate wage demands and low unemployment through coordination. This implies that a strict central bank is not necessary to achieve moderation. On the contrary the gains from coordination are larger if the central bank is accommodating and hence give unions a greater incentive to coordinate. Holden (2005) extends this logic to the effect of participating in a monetary union where the central bank cannot have as high disciplining effect on the wage setting in the member countries as under a strict national monetary regime. The study shows that participation in a union might give higher incentives to coordinate because of the lack of discipline from the monetary union. Hence, for a country with coordinated wage setting, participation in a monetary union will give lower equilibrium unemployment compared to a strict central bank, but higher equilibrium unemployment compared to an accommodating monetary regime.

Larsson Seim and Zetterberg (2013) investigate the effect of inflation targeting and central bank independence on unemployment and wage formation using data on 20 OECD countries in the period 1982-2003. Real wage equations and unemployment equations in models with country-specific fixed effects are estimated. When estimating real wage equations, no significant effect of coordination is found. Some type of price or wage rigidity is a requirement for monetary policy to have real effects. It is found that real wages are higher on average under inflation targeting than under a monetary union, and especially in economies with a high degree of coordination or centralization in wage setting. No effects on unemployment is found.

Calmfors and Larsson Seim (2013) investigate the consequences of different choices of wage leaders. It is questioned if pattern bargaining leads to wage restraint as it does in Norway. An open economy model with two sectors is used, and pattern wage bargaining and uncoordinated bargaining is modelled as a Stackelberg game and a Nash equilibrium, respectively. They show that choice of monetary regime is crucial for the effects of wage leadership. Under inflation targeting, pattern wage bargaining with tradable or untradable sector as wage leader give the same outcome as uncoordinated bargaining. This is because the central bank is assumed to prevent the consumer price index (CPI) from changing. However, if the central bank pursue flexible inflation targeting, this equivalence is broken. Under a monetary union the real wage of the leading sector is higher with coordination than with uncoordinated bargaining when tradable sector is leading, and lower if non-tradable sector is leading. Unlike conventional wisdom, this implies that aggregate employment is higher with the non-tradable sector as wage leader, then with tradable. By use of a trade-union utility function that depend on a reference wage, it is shown that "comparison thinking" and loss aversion might promote wage restraint and high employment.

However, Gjelsvik et al. (2015) show that the change in monetary policy in 2001 to inflation targeting did not make pattern bargaining less important in Norway. Gjelsvik et al. (2015) investigates the persistence of pattern bargaining in Norway given the transition to inflation targeting in 2001 and the surge in immigration from 2004. Pattern wage bargaining and collective agreements have been central in the Norwegian wage formation for more than 50 years. The analysis concludes that wages in manufacturing still adjusts towards the average wage share, and the other sectors follow the reference wage. Hence, pattern wage bargaining is still important in explaining the Norwegian wage formation. They find a high degree of wage following and that the wage share is determined by profitability in manufacturing. The surge in immigration have lead to lower wage growth through weaker bargaining power, but they find no notable effect of the transition to inflation targeting. This pattern serves as a foundation for the empirical analysis in this thesis.

Previous literature is the basis for further analysis of disaggregated wage relations and the effects of coordination on hourly wages. Theory of wage formation is needed as a foundation for empirical analysis. Calmfors and Larsson Seim (2013) and Bjørnstad et al. (2002) provide theory of modelling wage relations in the next section.

3 Theory

In this section, theory is presented as a foundation for empirical analysis. The model in Calmfors and Larsson Seim (2013) is used to illustrate how coordination and monetary policy affects wages in a basic wage model with pattern wage bargaining. Then theory by Bjørnstad et al. (2002) is used to illustrate wage setting for different skill groups. The empirical equation used in this analysis is based on Bjørnstad et al. (2002), but incorporates coordination and immigration.

3.1 The effect of coordination on hourly wages

The model is a small open economy model by Calmfors and Larsson Seim (2013). There is one tradable sector and one non-tradable sector, each made up by a continuum of perfectly competitive and identical firms. Households have identical utility functions and consists of one group of workers and one group of capitalists. Both firms and households take prices as given. The monetary target is given and considered credible. The first stage in the timing of the events, is that the nominal wage is set through bargaining between one union and one employer organisation. The central bank determines monetary policy in the second stage, and in stage three, production, employment, consumption and prices, are determined. The model is solved by backward induction, and the equilibrium is subgame perfect. The main equations of the model are:

$$N_i = (\frac{W_i}{P_i})^{-\eta_i} \tag{1}$$

$$Y_i = \frac{1}{\theta_i}(\frac{W_i}{P_i})^{-\sigma_i} \tag{2}$$

$$\Pi_i = \frac{1}{\eta_i - 1}\frac{W_i}{P}(\frac{W_i}{P_i})^{\eta_i} \tag{3}$$

$$\tilde{C}_N = \gamma \ \frac{\tilde{I}}{P_N} \tag{4}$$

$$\tilde{C}_T = (1-\gamma)\frac{\tilde{I}}{P_T} \tag{5}$$

$$\frac{P_N}{P_T} = (\frac{\gamma}{1-\gamma})^{1-\theta}(\frac{W_N}{W_T})^{\theta} \tag{6}$$

Equation (1) is employment in a representative firm in sector i, and is derived from the first order condition for profit maximisation, as in Calmfors and Larsson Seim (2013). W_i is the nominal wage in the sector, and P_i is the product price in the sector, where i is either N (non-tradable) or T (tradable). $\eta_i = (1-\theta_i)^{-1} > 1$ is the labour demand elasticity with respect to the real product wage. θ is the production technology, and this is equal in the two sectors. The corresponding supply function is presented in equation (2). $\sigma = \theta/(1-\theta)$ is the output elasticity with respect to the real product wage. Equation (3) is the firm's profit function with the profit maximising levels of employment and output. $\frac{Wi}{P}$ is the real consumption wage and $\frac{Wi}{P_i}$ is the real product wage. Thus, real consumption wage affects real profits positively and the real product wage affects real profits negatively.

Equation (4) is the aggregated demand in the non-tradable sector, and equation (5) is the aggregated demand in the tradable sector. γ is the budget share of non-tradable goods and can be considered a measure of the openness of the economy. $\tilde{I}$ is the aggregated income and P_N is the price of the non-tradable good. The demand function is derived from the household's consumption function, as in Calmfors and Larsson Seim (2013). The preferences of the households are Cobb-Douglas, and the households maximise their utility subject to their real income which depends on whether they are workers, capitalists or unemployed.

The products of the tradable sectors are perfect substitutes across countries, and the price is determined on the world market. A zero-savings assumption is imposed on the households so nominal aggregate expenditure must equal nominal aggregate income. Clearing the domestic market for non-tradable implies $Y_N = \tilde{C}_N$. It then follows that $Y_T = \tilde{C}_T$. The relative market-clearing condition (6) is obtained by combining this information with the supply function (2) and demand functions (4) and (5). The relative wage, W_N/W_T, uniquely define the relative price P_N/P_T, and an increase in the relative wage causes a less than proportional increase in the relative price because of the elasticity $\theta < 1$. Using this, the employment equation can be rewritten and shows that employment in one sector depends negatively on real consumption wages in both sectors.

Under inflation targeting, the central bank is expected to keep the CPI from changing, $dlnP = 0$. In a monetary union with a fixed exchange rate the central bank is expected to keep the price of the tradable good from changing, $dlnP_T = 0$. The effects on prices that wage setters perceive their wage decision to have, differ depending on the monetary regime and the bargaining arrangement.

3.1.1 Wage setting

According to Calmfors and Larsson Seim (2013), wages are set through bargaining between one union and one employer organisation in each sector. The employers want to maximise profit of a representative firm and the union want to maximise the rents from unionisation. Workers are risk neutral, which means that the utility of an employed worker equals the real consumption wage, w_i. Jobs are randomly assigned among the workers in each sector, and the utility of an unemployed worker is b, which is exogenously given and can be considered as the value of home production. The nominal wage W_i in sector i is set to maximise a weighted average of the utilities of the union and the employers. The utility of the union in sector i is

$$V_i = N_i w_i + (L_i - N_i)b - L_i b = N_i(w_i - b) \tag{7}$$

where L_i is the number of union members per firm in sector i. The optimisation problem is

$$max_{wi}\Omega_i = [N_i(w_i - b)]^{\lambda_i}{\Pi_i}^{1-\lambda_i} \tag{8}$$

where λ_i is the relative bargaining power of the union in sector i. The constraints of the optimisation problem differ depending on monetary regime and bargaining set-up. The first two constraints are equations(1) and (3), and the other constraints are

$$P = P(W_i, W_j) \tag{9}$$

$$P_i = P_i(W_i, W_j) \tag{10}$$

$$W_j = f(W_i) \tag{11}$$

The first order condition for maximization is

$$\Omega_{W_j} = \lambda_i[\frac{w_i\epsilon_i}{w_i - b} - \eta\varphi_i] + (1 - \lambda_i)[\epsilon_i - \eta\varphi_i] = 0 \tag{12}$$

where ϵ_i is the elasticity of the real consumption wage with respect to the nominal wage, and φ_i is the elasticity of the real product wage with respect to the nominal wage. The condition states that in optimum, a marginal increase in nominal wage gives no change in the weighted average of the utilities of the two parties, $\Omega_{W_j} = 0$. This implies that the marginal gain of a wage increase for the union must equal the marginal loss for the employer organisation. The difference between

the utility gain from higher real consumption wage and utility loss of higher unemployment is the marginal gain for the union. Solving for w_i, we obtain an expression for the real consumption wage.

$$w_i = \frac{W_i}{P} = (1 + \lambda_i M_i)b \tag{13}$$

$M_i = \epsilon_i/(\eta\varphi_i - \epsilon_i)$, where ϵ_i and φ_i depend on monetary regime and the wage-setting arrangement. Hence, the equilibrium differ with the monetary regime and the wage-setting arrangement. The real consumption wage equals the value of unemployment plus a mark-up that depends on the relative bargaining power and M_i.

Pattern bargaining is modelled as a Stackelberg game where the wage leader internalises the impact of its wage setting on the wage of the follower, while the wage follower takes the leader's nominal wage as given. Calmfors and Larsson Seim (2013) show that the elasticity of the followers nominal wage with respect to the leader's nominal wage equals the elasticity of the CPI with respect to the leader's nominal wage. This means that the leader internalises the effect on prices of wages in both sectors, and that the wage in the following sector is uniquely determined by equation (13) for a given value of unemployment.

3.1.2 Wage setting with wage norms

Wage comparisons play an important role in collective bargaining, as wage-increase in a key sector tend to become a reference norm for other sectors in subsequent agreements. According to Calmfors and Larsson Seim (2013), there is a strong tendency for wage increases in other sectors to follow the wage norm. The utility function for the union in sector i is now

$$V_i = N_i(\tilde{w}_i - b) = N_i(\frac{{w_i}^{1+\alpha_k}}{{w_n}^{\alpha_k}} - b) \tag{14}$$

α_k is a measure of the importance of wage comparisons. Following the Kahneman-Tversky hypothesis of loss aversion, α_k is positive if the wage is below the comparison norm, and zero if the wage is above the norm. This means that the unions with wage below the norm will follow the wage norm, while those with wage above the norm will disregard it. The new utility function in equation (14) replaces equation (7) as the weighted utility function to be maximised. We assume that the wage follower compare with the wage leader so that the real consumption wage in the leader sector serves as the reference norm. Hence $w_n = w_i$ as subscript i represent the wage leader and j represent the follower. The wage leader's union utility function will be the same as before, but the maximisation problem will be more complex. This is because the wage leader must internalise

various types of equilibria for the wage follower. The wage follower's union utility depend on the wage norm. Because of the discontinuity of the union utility function there can be a corner solution or an interior solution. In the corner solution it is optimal for the follower to set the wage equal to the leader's wage. In the interior solution the real wage of the follower will be a mark-up on a weighted geometric average of the value of unemployment and the wage norm. The interior solution is observed in the data on Norwegian wage settlements.

3.2 Heterogenous labour market

Bjørnstad et al. (2002) distinguish between high- and low-skilled workers by the length of education in a pattern wage bargaining model. The theory is relevant for the disaggregated approach in this study, as they disaggregate the work force by education and sector. The model is based on Aukrust's main-course model for Norwegian wage setting. Aukrust's main-course model is a long term model of inflation that has become the framework for forecasting and judgement about negotiated wage growth in Norway. This model describes wage- and price-setting, and is thoroughly presented in Bårdsen et al. (2005). It originates from 1966 and was created by Aukrust, Holte and Stoltz on an assignment from the government (Bårdsen et al. (2005), p.36).

In the model by Bjørnstad et al. (2002), demand for skilled labour relative to unskilled labour (N_s/N_{us}) is assumed to depend negatively on relative wages (W_s/W_{us}), and positively on skill biased technology change (SBTC), represented by a trend t. Wages are assumed to be set in negotiations between unions and employer organisations at a national level, as well as at a decentralised level. The demand for labour is

$$\frac{N_s}{N_{us}} = f(\frac{W_s}{W_{us}}, t) = \frac{1-u_s}{1-u_{us}}/(s^{-1}-1) \tag{15}$$

where relative demand is a function of relative wages and the SBTC-trend. u_s is unemployment for skilled workers, u_{us} is unemployment for unskilled workers, and s is the share of skilled labour in the total labour force. The equation states that if there is SBTC, which equals an increase in t, the skill premium will have to increase if relative employment is to be constant unless the share of skilled workers, s, increases. The wage curve depend on the skill-specific unemployment rates:

$$\frac{W_s}{W_{us}} = g(\frac{u_s}{u_{us}}), g' < 0 \tag{16}$$

There is a negative relationship between relative wages and relative unemployment rates. If wages are affected by the skill-specific unemployment rates, and not just the average unemployment rate,

skill premium adjusts to avoid skill mismatch. The wage relations depend not only on the unemployment rates, but also on producer prices, P, and average labour productivity by sector, Q.

$$W_s = PQg(u_s, u), g'_{s1}, g'_{s2} < 0 \tag{17}$$

$$W_{us} = PQg(u_{us}, u), g'_{us1}, g'_{us2} < 0 \tag{18}$$

The determination of relative wages and unemployment is illustrated in figure (1). Equation (15) is illustrated as the upward sloping line A, and equation (16) is illustrated as the downward sloping curve B. An increase in SBTC, higher t, leads to a upward shift in the demand curve, and hence to higher skill premium and lower relative unemployment for skilled workers, ceteris paribus. An increase in the share of skilled workers relative to unskilled, higher s, leads to a downward shift, and hence lower skill premium and higher relative unemployment for skilled workers, ceteris paribus. According to Bjørnstad et al. (2002), this is in line with Norwegian experience after the early 1970s. A reduction in s can be interpreted as an increase in government employment, as government employment is exogenous and an increase leads to reduced access to skilled labour for the private sector.

An increase or decrease in the bargaining power for one of the skill-groups give a shift in the wage curve, curve B i figure (1). An increase in bargaining power for high skilled workers would shift the wage curve out.

The slope of the wage curve describes the wage responsiveness in wage settlements to skill-specific imbalances like SBTC. The fact that the curve is convex indicates that wage responsiveness is larger in settlements when unskilled workers take up a large share of unemployment compared to settlements where both skill-groups experience high unemployment rates.

Bjørnstad et al. (2002) present an empirical specification of this theory in an appendix:

$$\begin{aligned}\Delta wc_{mit} = \gamma_{0i} - \gamma_{1i}(wc_{mi} - q_m - pr_m)_{t-1} - \gamma_{2i}u_{t-1} - \gamma_{3i}u_{it-1} + \gamma_{4i}\Delta q_{mt} \\ +\gamma_{5i}\Delta pr_{mt} + \Delta pc_t - \gamma_{7i}\Delta u_t - \gamma_{8i}\Delta\ u_{it} + \gamma_{9i}z_{it} + \epsilon_{it}\end{aligned} \tag{19}$$

where wc_m is wage costs, q_m is producer prices, pr_m is labour productivity, and $(wc_{mi} - q_m - pr_m)_{t-1}$ is the wage share-term, also referred to as the error-correction-term. u is the general unemployment and u_i is education specific unemployment. pc is the consumer price index, and z is a vector of other variables like time-specific dummies. m specifies that the equation is for the manufacturing sector. The equations for the public sector and the private services sector are similar, but the

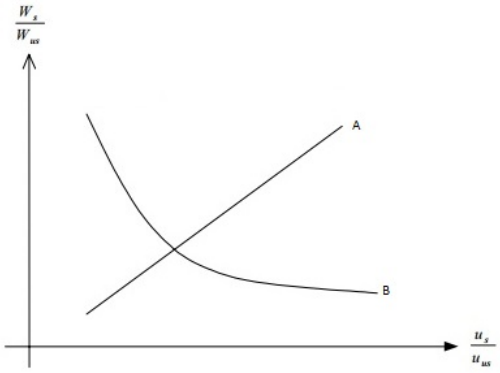

FIGURE 1: Determination of relative wages and unemployment

wage share-term is substituted by a reference wage-term and fewer of the explanatory variables are included.

Coordination is incorporated in the model by the wage share-term in manufacturing and the reference wage-terms in the other sectors. These are error-correction-terms as their estimated effects describe how fast wages adjust towards the equilibrium wage share or reference wage. In manufacturing, the wage share-term is log of hourly wage costs relative to producer prices and productivity. The functional income distribution describes how the value of produced outcome is distributed between workers and other input, and the wage share is labour's share of output. The actual wage share may change due to different shocks, while the equilibrium wage share is estimated to be constant at a specific percentage level in the long run. The estimated effect of the wage share-term describes the speed in which wages adjusts to close the gap between the actual and the equilibrium wage share.

In public sector and private services, the reference wage-term is log of hourly wages relative to the reference wage. The reference wage in public sector is a weighted average of wages in manufacturing and private services, as well as unemployment benefits, capturing the alternative wage for a worker. The actual relationship between wages in the sector and the reference wage may change due to shocks, while the equilibrium relationship is estimated to be a specific percentage level in the long run. The estimated effects of the reference wage-terms describe the speed in which wages adjusts to close the gap between the actual and the equilibrium relationship between wages and the reference wage.

3.3 From theory to empirical specification

The main merit of the theoretical model by Calmfors and Larsson Seim (2013) is that it makes transparent how wages depend on the choice of wage leader, "comparison thinking" and coordination in wage settlements. The main merit of the theoretical model by Bjørnstad et al. (2002) is that it makes transparent how changes in immigration, monetary policy and the degree of coordination affects wage growth for workers with long education relative to workers with short education. However, the theories are based on a set of assumptions that may be unlikely to hold in practice. Examples are identical firms, a perfect competitive market, and fixed labour supply. Because of this, the theoretical equations must be altered somewhat to avoid undesirable statistical properties when estimating on time-series data. The possibility of a causal relationship between coordination and wages is not constrained by the assumptions made in these theories, but is relevant for a broader set of models.

The estimation in this thesis is based on the wage relations by Bjørnstad and Skjerpen (2006) to investigate disaggregated effects of pattern wage bargaining. By using their specifications for the five educational groups and the three sectors, the estimation results can be compared, and the results may indicate changes in pattern wage bargaining and the other determinants of wage growth. The results in section 7 will show that the wage relations are changed, but following Gjelsvik et al. (2015), pattern wage bargaining is assumed. In order to fully capture the effects of coordination on hourly wages, the wage relations are extended with an index of coordination.

In order to make inference about the effects of coordination on hourly wages the model must have good statistical properties, and hence additional explanatory variables will be included in the model. Variables that are expected to affect wages on a long or short term basis is included to compose a model that fits the actual development traced in the data. This is done by Bjørnstad et al. (2002) in equation (19), and this equation is the basis for the wage relations by Bjørnstad and Skjerpen (2006). Their equations are constructed, and restrictions imposed, after a general-to-specific procedure. The following equations are as in Bjørnstad and Skjerpen (2006), but incorporates the additional coordination and an interaction term between coordination and the error-correction-terms, as well as a variable capturing immigration. The interaction term is included because the coordination captured by the index is not independent from the coordination captured by the error-correction-term.

Manufacturing:

$$\begin{aligned}\Delta wc_{mit} = \gamma_{0i} - \gamma_{1i}(wc_{mi} - q - z)_{t-1} - \gamma_{2i}u_{t-1} - \gamma_{3i}u_{it-1} + \gamma_{4i}(wc_{mit-1} - wc_{git-2}) - \gamma_{5i}D_{1988-1997} \\ +\gamma_{6i}\Delta wc_{mit-1} + \gamma_{7i}\Delta z_t - \gamma_{8i}\Delta h_t + \gamma_{8i}\Delta p_t - \gamma_{9i}D_{WF} - \gamma_{10i}D_{93} - \gamma_{11i}\Delta u_t \\ -\gamma_{12i}\Delta\ u_{it} - \gamma_{13i}Coord_t - \gamma_{14i}((wc_{mi} - q - z)_{t-1} * Coord_t) - \gamma_{14i}Immigration + e_{it}\end{aligned} \tag{20}$$

Public sector:

$$\begin{aligned}\Delta ww_{git} = \gamma_{0i} - \gamma_{1i}(ww_{gi} - kwa_{gi})_{t-1} - \gamma_{2i}u_{it-1} + \gamma_{3i}D_{1988-1997} + \gamma_{4i}\Delta ww_{git-1} + \gamma_{5i}\Delta kwa_{git-1} \\ +\gamma_{6i}\Delta p_t - \gamma_{7i}\Delta\ u_{it} - \gamma_{8i}Coord_t - \gamma_{9i}((wc_{mi} - q - z)_{t-1} * Coord_t) - \gamma_{10i}Immigration + e_{it}\end{aligned} \tag{21}$$

Private services:

$$\begin{aligned}\Delta ww_{sit} = \gamma_{0i} - \gamma_{1i}(ww_{si} - kwa_{si})_{t-1} + \gamma_{2i}\Delta ww_{sit-1} + \gamma_{3i}\Delta kwa_{sit-1}\gamma_{4i}\Delta^2 p_t - \gamma_{5i}\Delta u_t \\ -\gamma_{6i}\Delta\ u_{it} - \gamma_{7i}Coord_t - \gamma_{8i}((wc_{mi} - q - z)_{t-1} * Coord_t) - \gamma_{9i}Immigration + e_{it}\end{aligned} \tag{22}$$

The notation is different from Bjørnstad et al. (2002), but the content is the same. ww is hourly wages, $wc(= ww + tf)$ is hourly wage cost and $tf = log(1 + payrolltaxrate)$ is the payroll tax paid by employers. q is producer prices, z is labour productivity, u is the general unemployment and u_i is education specific unemployment. p is the consumer price index, h is normal working hours. $D_{1988-1997}$ and D_{WF} are dummies from Bjørnstad and Skjerpen (2006). Coord is the coordination index presented in the next section, and $((wc_{mi} - q - z)_{t-1} * Coord_t)$ is the interaction term. Immigration captures the flow of immigration in percent, and $e_{it}$is the error-term. m specifies that the equation is for the manufacturing sector, g is public sector, and s is private services. i specifies educational group and t specifies time period. In the equations for the public and private sector the error-correction-term is substituted by a wage following-term, and fewer of the explanatory variables are included. All variables, except Coord and Immigration, are in logarithmic scale and Δ indicates that the variables are measured in first differences.

The short term variables are changes in unemployment rates, changes in consumer prices and other variables that may affect growth in hourly wages in the short term. The long term variables are the wage share in manufacturing, the wage following-term in the other sectors, and the level of the unemployment rates and immigration. Coordination is expected to have an effect according to the wage relation presented in equation (13) in the theory by Calmfors and Larsson Seim (2013). The coordination variable is made operational in the next section, where the Norwegian coordination index is presented.

4 Coordination in Norwegian wage settlements

Indicators of coordination in wage settlements are developed and applied for many countries, see section 4.3, but they provide little information about variation in coordination within countries over time. To capture this effect, the Norwegian coordination index is more detailed and studies each year's wage settlements thoroughly. The index is based on previous work by Barkbu (2000), and presented in section 4.2. Section 4.4 compares this index to the coordination indicator by Kenworthy (2001). The main characteristics of the wage setters is described in section 4.1.

4.1 The main wage setters in Norway

The main participants in Norwegian wage settlements are four large trade unions and four large employer organisations in addition to the state mediator. The main trade unions are the Norwegian Confederation of Trade Unions (LO), The Confederation of Vocational Unions (YS), The Federation of Norwegian Professional Associations (Akademikerne), and The main organization for university and college graduates (Unio). The main employer organisations are the Confederation of Norwegian Enterprise (NHO), the Enterprise Federation of Norway (Virke), The Norwegian Association of Local and Regional Authorities (KS), and the Employers Association Spekter. These participants coordinate their work and demands in different degrees depending on different factors such as whether it is main settlements or intermediate settlements.

The main agreement between the largest trade union, LO, and the largest employer organisation, NHO, is called "Hovedavtalen" and was signed for the first time on the 9th of March 1935, according to Bergh (2010). This agreement is referred to as the constitution of Norwegian working life, and it was the basis for developing the Norwegian system of collective wage bargaining. Bergh (2010) highlights three characteristics of the Norwegian model for working life and wage setting. The first is the strong and lasting degree of centralising and coordination, exemplified by the endurance of the strong position of the largest trade union, LO, and the largest employer federation, NHO, in wage setting. The second is a particularly high degree of stability in the climate of cooperation between the unions and the employer organisations. And the third characteristic is the active and harmonic cooperation with the state, especially on income policy issues. It did not take long after the signing of the agreement in 1935 before the cooperation expanded to a tripartite cooperation between the state, LO and NHO to ensure consensus on tariff policy (Bergh, 2010: 14-15).

4.2 The Norwegian coordination index

An important objective of describing the degree of coordination is to measure to which extent the wage setters internalize the impact of their wage claims on the aggregate outcome. Barkbu (2000) developed a coordination index for Norwegian wage settlements for the years 1961 to 1999. The coordination index consist of five sub-indicators. The sub-indicators are made to measure different aspects of coordination, and a value on each of these make up the overall value of coordination for each year. The new Norwegian coordination index for the years 1990 to 2014 is based on the index by Barkbu (2000), but is modified to become more reliable. The coordination-variable in the estimation will have values from Barkbu (2000) for the years 1972 to 1989 and from the new index for the years 1990 to 2012.

Measuring wage coordination has an element of subjectivity as it is not directly observable and hence it is impossible to create completely objective measures. To minimize the element of subjectivity in the coordination index for Norway, three measures has been taken. The first is that strict guidelines for valuing the indicators are made, and these are described in detail in appendix G. The second is that the valuation of indicators are clearly and carefully documented. This documentation is in appendix H. The third measure is that the index is made with only one source of information, the reports by TBU. This is to prevent subjective collection of information. All information presented in the committees reports of last year's wage setting is included in the determination of the values on the indicators. The source is selected because the role of TBU is to facilitate that the parties in the wage settlements, and the authorities, have the best possible common understanding of the situation in the Norwegian economy. TBU have members from the main unions, the main employer federations, the government, and from Statistics Norway. Hence the committee is considered unbiased in their reporting.

In the new Norwegian coordination index, the sub-indicators can take values between zero and one, and the sum make up the overall coordination for one particular year. The first reflect the organisation of the wage settlements, and the degree of centralisation is captured in this sub-indicator. The second sub-indicator reflects government contribution in the settlements in private services beyond the frame of organisation. The third and fourth sub-indicators reflect coordination between the unions, and between the employer organisations, respectively. The last sub-indicator reflects the coordination between the unions and the employer organisations. See appendix G for a detailed description of the indicators.

Table 1 displays the values of the sub-indicators and the aggregate value of the Norwegian coordination index for the years 1990 to 2012. The aggregate value can vary between zero and five, but with one exception the actual value vary between three and five in all years. This indicates that the degree of coordination is high in Norwegian wage settlements, in line with previous literature. The exception is 1998 where the value is 2,87. This year the wage settlement was characterized by a high degree of disagreement between the unions, and conflict between unions and employers.

4.3 Other indicators of coordination, and studies of their reliability

Kenworthy (2000) offers a survey and assessment of 42 different indicators of corporatism, among them are indicators of coordination in wage setting and bargaining arrangements. Cameron (1984), Calmfors and Driffill (1988), Golden, Wallerstein and Lange (1997) and Iversen (1998) are presented as the most important contributions to centralization indicators, and Soskice (1990), Kenworthy (2000) and Traxler and Kittel (2000) are presented as the most important contributions for coordination indicators. The analysis of the indicators concludes that there is little justification for using time-invariant measures, that an element of subjectivity in the indicators are unavoidable, and that users of composite measures must offer a compelling explanation of why corporatism is more accurately captured by aggregated indicators than by a narrow single indicator.

Kenworthy (2001) consider wage coordination as a behavioral concept that refers to the degree of intentional harmonisation in wage setting. It is argued that there are severe difficulties associated with measuring this behavioral concept in a way that can be compared across countries. The index on wage coordination presented is therefore based on the structural characteristics of wage formation. The values represent the expectations of the institutional aspects of wage formation which can generate a higher degree of coordination. The values therefore represent a hypothesis or prediction, rather than a measure of coordination. The coordination index can take values from 1 to 5 where 5 reflects the highest degree of coordination. For a country to obtain value five in a given year there has to be centralised bargaining by peak confederations, extensive pattern wage bargaining and more, see Kenworthy (2001). The scores cover 18 OECD countries from 1960 to 2000. Figure (2) shows how the index for Norway vary between value four in main settlements and value five in intermediate settlements for most of the period.

Visser (2011) uses roughly the same method as Kenworthy, but covers more countries and years. Data is from various national and comparative sources, including Traxler (1994); OECD (2004); European Industrial Relations Online; and the Global Wage Surveys of the ILO. The data

TABLE 1: Coordination index for Norwegian wage settlements

	I1	I2	I3	I4	I5	Sum
1990	1	0,5	1	1	0,42	3,92
1991	1	0,7	1	1	0,67	4,37
1992	0,75	1	0,84	1	0,50	4,09
1993	1	1	1	1	0,78	4,78
1994	0,67	0,7	1	1	0,44	3,81
1995	1	0,5	0,84	1	0,54	3,88
1996	0,67	0,7	1	1	0,67	4,04
1997	1	0,7	1	1	0,58	4,28
1998	0,67	0,7	0,75	0,50	0,25	2,87
1999	1	0,7	1	1	0,50	4,20
2000	0,75	0,7	1	1	0,37	3,82
2001	0,67	0,7	1	1	1	4,37
2002	0,67	0,5	0,56	1	0,65	3,38
2003	1	1	1	1	0,79	4,79
2004	0,67	0,7	1	1	0,50	3,87
2005	1	0,5	0,88	1	0,95	4,32
2006	0,67	0,7	0,86	0,80	0,50	3,53
2007	1	0,5	0,88	1	0,76	4,15
2008	1	0,7	1	0,80	0,48	3,98
2009	1	0,5	1	1	0,61	4,11
2010	0,67	0,7	0,86	0,80	0,60	3,59
2011	1	0,5	1	1	0,93	4,43
2012	0,67	0,5	0,75	1	0,5	3,43

is collected in Visser's "Data Base on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, 1960-2011" (ICTWSS). The database covers trade unionism, wage setting, state intervention and social pacts, and the part on wage setting is focusing on features such as bargaining coverage, level and type of coordination, government intervention, minimum wage setting and more. The indicator on coordination of wage-setting is based on Kenworthy (2001), and can take the same values.

Lindgren (2007) investigates the critique of four of the most frequently used measures of wage coordination by Nickell et al (2005), Kenworthy (2001) and Traxler et al. (2001). The critique investigated is built on two arguments. The first is that different coordination indicators measure different things because of the multidimensionality of wage coordination. The second argument is that coordination indicators suffer from severe measurement error, mainly because of subjective ranking. Using confirmatory factor analysis, the analysis finds strong support for the hypothesis of a single dimension underlying the four indicators. Using the ratio of the variance due to the underlying factor to the overall variance of the indicator, it is found that all four indicators are fairly reliable despite subjective rankings (Lindgren, 2007: 18). Using Chi-square, it is found that the model fits data rather well. The key finding is that the critique investigated in the analysis is largely unwarranted. Nonetheless, it is possible to improve the measures of coordination by using multi-indicator measures that is more valid and reliable than the individual indicators (Lindgren, 2007: 26).

Regini (2000) investigates the responses of ten European economies to globalization with focus on regulation of labour markets, collective bargaining and social security. The study concludes that while bargaining decentralization was a uniform trend in the 80s, the 90s showed diverging trends between deregulation and concertation, including increasing use of social pacts for national competitiveness (Regini, 2000: 14). The development in Norwegian wage bargaining is described with decentralization in the 80s and recentralization in the 90s highlighting the social pact "Solidaritetsalternativet" from 1993 (Regini, 2000: 27). Italy, the Netherlands and Ireland have also experienced decentralization with more coordination, while Great Britain, France, Spain, Denmark, Sweden and Germany have had more decentralization without more coordination (Regini, 2000: 25).

Marginson (2014) has conducted a study showing that the viability of coordinated bargaining in Europe is under threat, and that this has intensified after the financial crisis. There are three main arguments behind this. The first is that even before the crisis there was pressure for decentralisation and this has reduced the capacity for unions and employer organisations to coordinate in

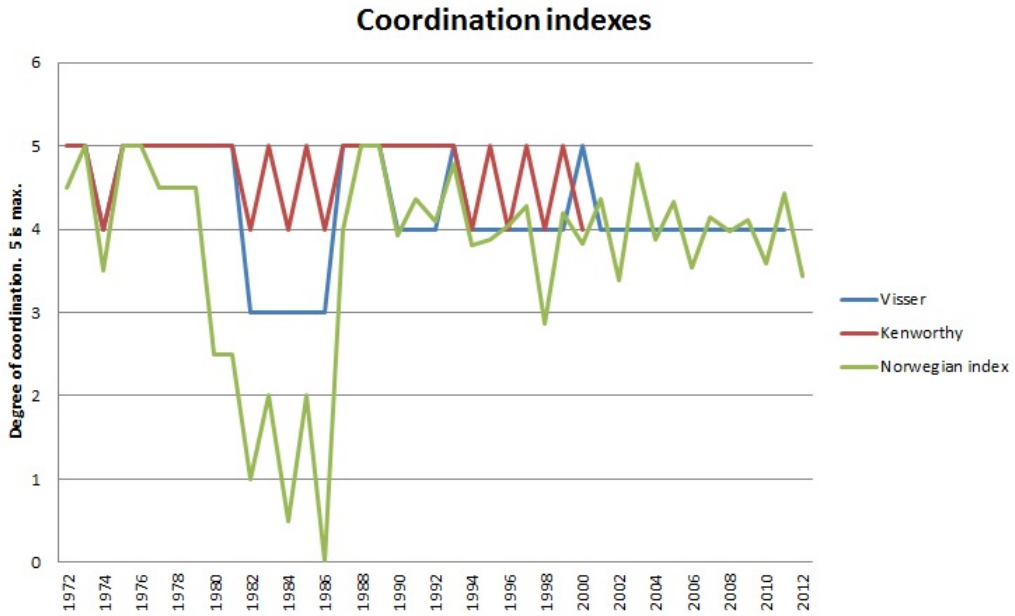

FIGURE 2: Comparing the Norwegian coordination index to Visser (2011) and Kenworthy (2001).

many countries. The second is that the crisis represents a critical moment for coordination where especially Northern Europe has experienced an incremental corrosion of coordination while Southern Europe has experienced a frontal assault on coordination imposed by the IMF, ECB and European Commission. The third argument is that the European integration creates pressures for wage coordination across national borders to improve competitiveness, but authorities have embraced prescriptions driving in the opposite direction. Marginson finds that there has been an incremental corrosion of the standard-setting capacity of sectoral agreements. The extent of this development differ among countries, but the crisis has accelerated the movement away from universal sector-wide standards.

4.4 Comparing the Norwegian coordination index to other indexes

The Norwegian coordination index is compared to the indexes by Visser (2011) and Kenworthy (2001), as these well-known indexes to a large degree intend to measure the same as the Norwegian index. The Norwegian index differ by studying each wage settlement in one country in depth, while Visser and Kenworthy focus on apriori structural characteristics. Because it exploits within country variation to a larger degree than the other indexes, there is larger variation in the Norwegian index. Despite this, figure (2) show that all indexes present a somewhat similar development over time.

Barkbu (2000) shows that Norway departed from a strongly coordinated wage setting in the 1980s. The 80s were characterised by difficult settlements and major conflicts, and this has a great impact on the value of the sub-indicator for conflict in the index. The degree of coordination increased to a more normal level in 1987. This great decline in the degree of coordination is captured to some extent by Visser, but not at all by Kenworthy. This is mainly because the degree of consensus between the unions and between the employer organisations, and the degree of conflict between unions and employer organisations, is not assessed in these indexes.

With a few exceptions, the Norwegian index follows the development in the index by Kenworthy (2001). Even though the levels differ, the indexes increase and decrease together. 1992 and 1995 are two years where the development differ, and these exemplifies the difference between the indexes. In 1992, main settlements was conducted at the sector level in the private sector, the degree of conflict was high, and the degree of consensus between unions were low, according to NOU:5 (1994). This causes a decline in the Norwegian index, but the institutional settings measured in Kenworty's index do not change. In 1995 the Norwegian index do not have a steep increase in line with the normal variation between main and intermediate settlements. This is because there was no government contribution and the degree of conflict was quite high according to NOU:4 (1996). This is not captured in Kenworty's index. These examples show the difference between the Norwegian index and Kenworty's index, but figure (2) show that despite these differences the development is similar.

The coordination index by Visser (2011) follows the development in Kenworthy's index in the 1970s, but have some differences in the 80s and 90s. The difference is mainly caused by the fact that government contribution is not a part of Visser's index, except in the case of direct imposition of wage settlements or a statutory ban on contract renewals. In the ICTWSS database, government contribution is a separate variable from coordination. Another cause of the difference is that Visser's index do not include the level of negotiations, and hence it do not vary between main and intermediate settlements. In the 90s and 2000s the value on Visser's index is constant at four, except for the years 1993 and 2000, where the value is five. In the intermediate settlements in 1993 this was caused by a peace obligation in the settlements, see NOU:5 (1994), while it is not clear what causes the value five in 2000 as this contradicts the movements in the Norwegian index and the index by Kenworhty.

The comparison of the Norwegian index to these well-known and recognized indexes shows that the main development in coordination across the indexes is the same. The degree of coordination is high, as is shown by Visser (2011) and Kenworthy (2001), as they compare Norway to other

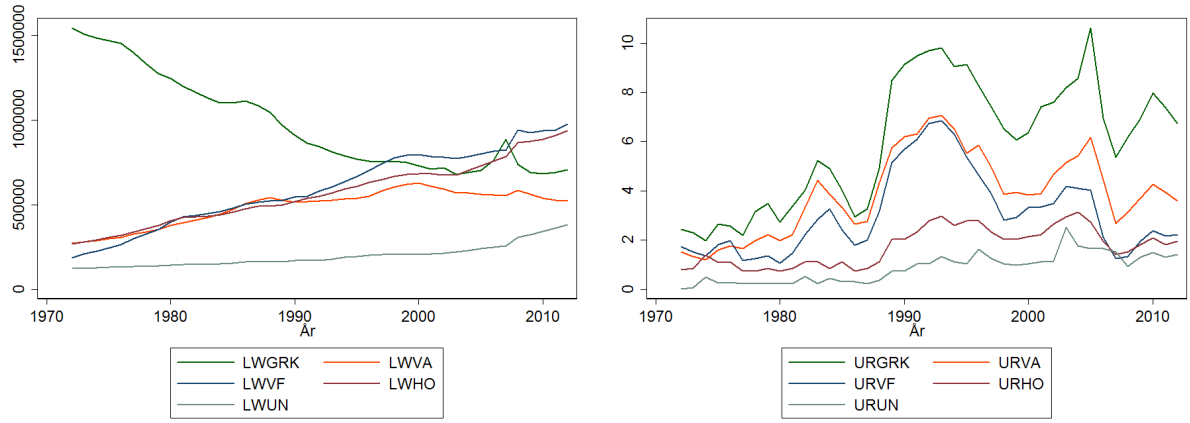

FIGURE 3: Employment measured in 1000 working hours (left) and unemployment in percent (right).

countries. The variation is larger in the Norwegian index because of the detailed studies of each settlement and each sub-indicator. This detail focus is imposed to be able to say more about the effect of coordination in wage settlements. In section 7 the results are presented and the effect of the detailed study in the Norwegian coordination index is discussed. The next section presents other explanatory variables in the wage relations.

5 Data

There has been a dramatic change in the composition of the labour force in the last forty years. There has been a massive decline in employment of workers with only primary education, and massive growth in employment of workers with higher education. Figure (3) display employment measured in 1000 working hours in the left panel. The development may be due to skill biased technology change, see Bjørnstad and Skjerpen (2006), but also because education has become more easily accessible and the work force has become more educated. However, the surge in immigration from 2004 is visible in the figure as a tip in the employment of workers with primary education. Since 2000, employment of workers with secondary education has decreased as well.

The data set is disaggregated into five educational groups to be able to investigate the differences between these groups. The first group includes all workers with primary education, defined as less than 11 years of formal education. The workers with 11-12 years of education is divided into two groups; secondary education and vocational education. Workers with low university education has 13-16 years of education, and the top educational group contain the workers with high university education. Formal education is used as an indicator of the worker‘s abilities and qualifications

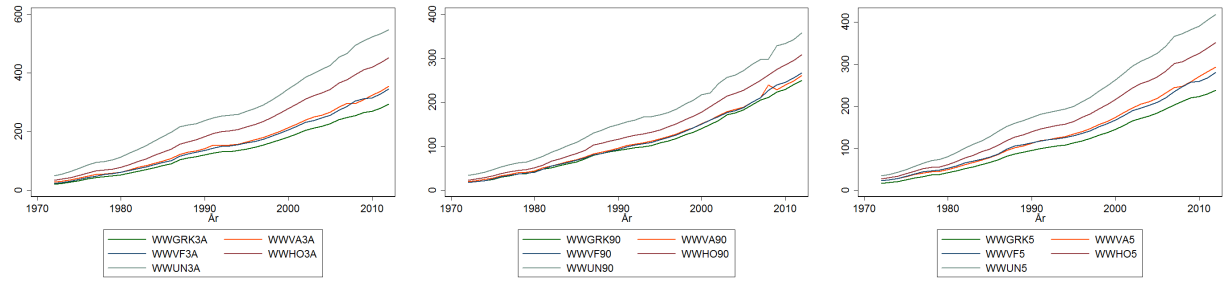

FIGURE 4: Development in hourly wages in manufacturing (left), public sector (middle) and private services.

because these are not directly observable. This is not without shortcomings as job experience may be just as important for abilities and qualifications as education in some sectors. Also, formal education has replaced job experience to some degree in the labour market, but this does not imply that workers abilities has increased. The groups of workers with longest education will be referred to as the top groups for simplicity reasons.

The right panel of figure (3) displays unemployment in percentage of the workforce for the educational groups. There was a steep increase in unemployment in the end of the 1980s due to the recession. After the financial crises there was a dip in unemployment due to counter-cyclical initiatives enhanced by the government. The level of unemployment is highest for workers with primary education, and is lower for each group by the length of their education. Unemployment in the least educated group has the largest variation, indicating that shocks like the financial crises affects this group stronger compared to other groups.

Figure (4) displays the development of hourly wages for five educational groups in manufacturing, public sector and private services. The development is similar across sectors, but the level is higher in manufacturing. The figure displays a fan-shaped development, indicating that the wage dispersion between the educational groups is larger than it was in the the 1970s. Growth in hourly wages has been largest for the workers with high university education, followed by the workers with low university education. The three lowest educational groups follow each other closely in public sector, while the workers with primary education is on a lower level in the other sectors.

Figure (5) shows that growth in hourly wages and coordination in wage-setting is negatively correlated. At times where coordination increases, wage growth decreases, especially since the end of the 1980s. Workers with primary education in manufacturing and workers with low university education in public sector are two large groups which include factory workers and teachers. These workers are the examples presented here, but the negative correlation is similar for all groups and

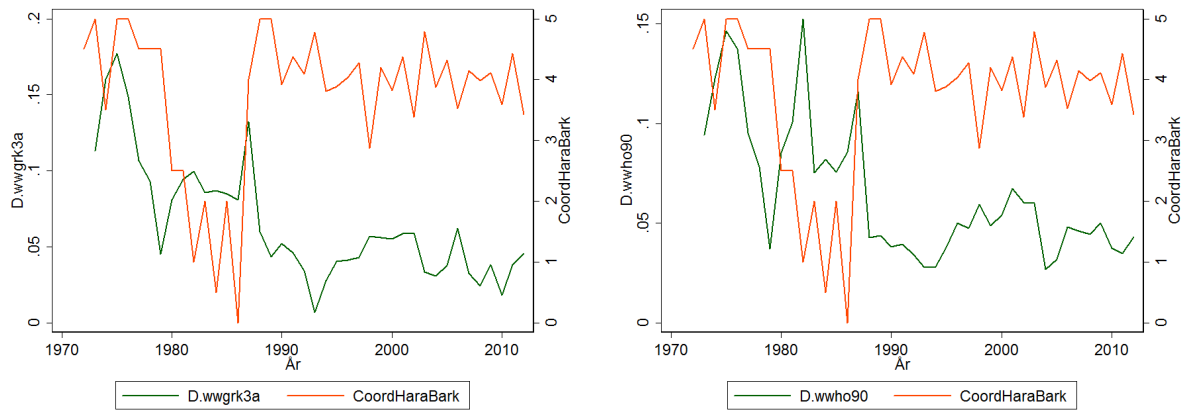

FIGURE 5: Wage growth and coordination for workers with primary education in manufacturing (left) and for workers with low university education in public sector (right).

sectors. This supports the notion of taking the degree of coordination into account when modelling wage growth.

6 Empirical issues

This section presents two different estimation methods used in the empirical analysis, as well as some comments on endogeneity issues and large outliers. The methods are used to estimate the wage relations in (20), (21) and (22) across three sectors and five educational groups.

The first method is related to how the wage equations for skill-specific groups in Norway were estimated by Bjørnstad and Skjerpen (2006). To relate the results from this thesis to previous literature, the starting point is to estimate the same equations with the same method, fixed effects analysis with cluster robust standard errors.

The other method accounts for the fact that wage setting is modelled to happen simultaneously for all educational groups within a sector, and that external factors such as policy measures may affect the wage setting in all groups simultaneously. Hence, there may be correlation in the error-terms across equations that can influence the estimates. Because of this, and because the explanatory variables differ across equations, the method of seemingly unrelated regression (SUR) is used to investigate the cross-educational group effects.

6.1 Panel data with fixed effects

Panel data vary over time and across educational groups, and one can therefore control for unobserved, individual heterogeneity (Wooldridge J. M. (2010), p.252). It is reasonable to expect that wage growth is affected by unobserved conditions that vary across educational groups, but not over time. Cross-section or time-series estimation do not control for such heterogeneity and may produce misleading result, but panel data estimation produce credible results when education-specific conditions are not directly observable.

Panel data provide more variation and hence more information, compared to cross-section data or time-series. More information implies that the estimated coefficients are more reliable. Panel data is also robust to certain types of omitted variable bias. However, there are some shortcomings with panel data regarding collection of data, such as attrition. The advantages are assumed to outweigh these shortcomings as the data set is balanced and contains macro data for forty years.

The standard panel data model include a composite error term (u_{it}) consisting of an unobserved component (c_{it}) and an error component that is assumed to be independent and identically distributed (e_{it}): ($u_{it} = c_i + e_{it}$). The fixed effects framework, unlike the random effect framework, allow regressors to be correlated with the unobserved component in the residual. It is reasonable to believe that the individual effects of the educational groups are correlated with regressors, as the length of education can be assumed to be correlated with regressors such as wage growth last year.

Fixed effects analysis with the least squares dummy variable estimator provides the best linear unbiased estimator of the coefficients if the following assumptions hold. The error assumptions required are the zero mean assumption ($E(e_{it}) = 0$), the homoscedasticity assumption ($var(e_{it}) = E(e_{it}^2) = \sigma_e^2$), the uncorrelated errors-assumption ($cov(e_{it}, e_{js}) = E(e_{it}, e_{js}) = 0$), and the assumption of no correlation between the errors and the explanatory variables ($cov(e_{it}, x_{2it}) = 0$), (Hill et al. (2012), p.541). In addition there is a strict exogeneity assumption stating that the explanatory variables are strictly exogenous conditional on the unobserved effect (Wooldridge J. M. (2010), p.252). This excludes lagged dependent variables and feedback. When this holds, the estimates are consistent, and when there is no autocorrelation, the estimates are efficient. The option of cluster robust standard errors allows errors to be heteroscedastic, and ensures no serial correlation in the error terms.

Estimation by least squares with dummy variables implies that individual heterogeneity is captured by individual dummy variables (Hill et al. (2012), p.543). A dummy variable is included

for all educational groups, except one. The intercept represents the base individual, which in this analysis is the educational group containing workers with primary education. The intercept for an individual represented by a dummy variable, equals the coefficient on the dummy variable plus the intercept for the base individual (Hill et al. (2012), p.541).

The Hausman test controls whether there is correlation between the regressors and an unobserved component in the residual (Hill et al. (2012), p.558). If there is correlation, then a fixed effects model is preferred to a random effects model, as a random effects model is inconsistent. Regardless, the fixed effects estimator converges to the true parameter value in large samples.

6.2 Seemingly unrelated regression

It is reasonable to believe that the error terms across the equations are contemporaneously correlated as some unobserved effects may affect all educational groups. The educational groups are similar in some respects and therefore it is likely that omitted factors such as business cycles and political changes will have similar effects on wage growth in the five groups within a sector. This implies that the error terms in the equations, at the same point in time, are correlated, and seemingly unrelated regression (SUR) takes this into account.

SUR is used to estimate equations for each educational group within a sector jointly in a system of equations. The equations in this analysis are estimated jointly as the educational groups are assumed to negotiate wages simultaneously. The approach captures the efficiency due to correlation of the disturbances across equations (Baltagi (2008), p.115).

The efficient estimator is the generalized least squares (GLS) estimator. This estimator is more efficient than ordinary least squares (OLS) used in for each equation if $\sigma_{ij} > 0$, or if the $\bar{X}_i$ matrices are different across equations (Baum C. F. (2006), p.237). Hence, SUR is more efficient than fixed effects analysis if there is correlation in the error-terms across educational groups, or if the explanatory variables differ across equations. As mentioned above, it is reasonable to believe that the error terms across the equations are contemporaneously correlated, and the equations of the educational groups contain several education-specific explanatory variables. Variables such as changes in education-specific unemployment differ across equations as they are education-specific. The efficiency gain from using SUR depends on the size of the correlation between the residuals, and is larger with higher correlation (Baum C. F. (2006), p.237). According to Hill et al. (2012) (p.567), the procedure is optimal under the assumption of contemporary correlation, and it is not necessary to adjust the standard errors , as were done using fixed effects with cluster robust errors.

Compared to fixed effects analysis, the approach is suitable to the data set as T is large relative to N (Hill et al. (2012), p.562). T is forty years in this analysis and N is five educational groups. The SUR-estimator is based on the large-sample properties of data sets with large T and small N where $T \to \infty$, and it may be considered a multiple time-series estimator. The SUR method requires that T exceeds N, and for the large-sample approximations to work well, the T observations per unit should be much larger than the N number of units (Baum C. F. (2006), p.237).

The approach is also useful for this analysis because it is easy to allow for full heterogeneity and to impose and test cross-equation restrictions. The model by Bjørnstad and Skjerpen (2006) is rich and will be reduced to attain more precise estimates. Estimating each equation jointly without restrictions gives full heterogeneity across educational groups, and the estimated effects can be compared to assess which restrictions to impose. By comparing the size of the estimated coefficients, it is assessed which cross-group restrictions are reasonable to impose according to data. Imposing equal coefficients is considered less strict than omitting variables and this procedure is therefore conducted first. Restricting coefficients across educational groups to be equal are evaluated by an F-test. With these restrictions imposed, it is assessed which variables to keep in the equations by testing whether the effects are significantly different from zero. The SUR-method makes it easy to conduct this procedure compared to fixed effects analysis, as each equation is estimated separately.

6.3 Endogeneity

In order to investigate the effect of coordination on wage setting, the coordination index is included in the specification, and is regressed on hourly wages. However, including coordination may cause endogeneity problems as coordination can affect wage growth and wage growth can affect coordination. This problem affects several of the explanatory variables included in the wage relations. Such issues are not considered in the rest of this thesis.

6.4 Time specific effects and large outliers

In the model by Bjørnstad and Skjerpen (2006), dummy variables for specific years is included to ensure plausible results by excluding time specific effects. The dummies control for specific events not specified by the empirical model, years where wage settlements were strongly influenced by external factors. An example of time specific effects in their specification is a change in payroll taxes in 1993, and this is handled by including a dummy variable which equals one in 1993 and is otherwise zero. Bjørnstad and Skjerpen (2006) also uses some dummy variables which are not

reported. Which dummies to include in the new wage relations based on a different data set was therefore decided by investigating the fit of the model. Standard error of the linear prediction was predicted, which can be interpreted as the standard error of the fitted value. Dummies were created for the years where the residual had the greatest deviations from zero.

The coordination index captures some of the same information as these dummies. Therefore, the dummies are excluded from the equation when the coordination index is included, and the model is evaluated again. To decide which dummies to include with greater precision and more independent of sample period, Oxmetrics/PCgive was used to find large outliers at a 5 % significance level. The automatic selection procedure uses an algorithm for automatic detection of outliers. The wage equations for all sectors and educational groups was estimated and zero, one or two dummies were included.

7 Empirical findings

This is not the first attempt, as previously mentioned, to estimate wage relations for different educational groups in Norway. By using the same method, variables and restrictions as Bjørnstad and Skjerpen (2006), inference can be made about how the wage relations have changed over time. Section 7.1 replicates some of the results of Bjørnstad and Skjerpen (2006), and focus is on the difference between their result and the new estimated results.

There are some incidents which may imply that the determination of wage growth is different today than it was at the beginning of the decade. The surge of immigration after 2004 may have changed the size and bargaining power of different educational groups, and the introduction of inflation targeting in 2001 may have affected the system of pattern wage bargaining. New wage relations are estimated using seemingly unrelated regression with full heterogeneity before imposing new restrictions and a new specification. Section 7.2 discusses the results.

Coordination is inherent in the wage relations through the imposed pattern wage bargaining. In other words, there exists a long term relationship between wage growth and wage share in manufacturing sector and between wage growth and reference wage in the other sectors. However, this does not capture the full variation in coordination between the wage setters. To account for the high degree of coordination in wage settlements, the Norwegian coordination index derived in section 4 is included in the wage relations in section 7.3.

As described in section 4, the Norwegian coordination index consists of five sub-indicators mea-

suring different aspects of coordination. One sub-indicator measure the degree of conflict between unions and employer organisations. These sub-indicators may have different or even contradictory effects on wage growth, which are not apparent when using the aggregate index. In section 7.4, the sub-indicators of the coordination index are included in the wage relation to investigate how different aspects of wage coordination affects wage growth.

7.1 Revised data

In this section, some of the results of Bjørnstad and Skjerpen (2006) are replicated. Their wage relations are used in Statistics Norway's macroeconomic model, ADMOD, and are therefore a natural starting point when estimating new wage relations. The estimated wage equations has both long- and short-term dynamics. The long term dynamics are the error-correction-terms capturing wage share in manufacturing and reference wage in the other sectors, and the level of general and specific unemployment. The short term dynamics are changes in consumer prices and other dynamics that affect yearly wage growth. The models are log-log models and the estimated coefficients can be interpreted as the percentage change in wage growth when the explanatory variable increases with one percent (Hill et al. (2012), p.157). When comparing the results to table B1 in Bjørnstad and Skjerpen (2006), changes in the coefficients may be interpreted as changes in the elasticity of growth in hourly wages with respect to the variables.

Table (2) displays the results of the fixed effects estimates of equations (20), (21) and (22) from section 3.3 without coordination and the interaction term. Dummies are reported in appendix E. The first row presents the estimated effects of the error-correction variable in manufacturing $((wc_{m,i} - q - z)_{t-1})$. The estimated coefficient is restricted to be equal for all educational groups and it is negative. The sign implies that an increase in hourly wages relative to productivity and producer prices is associated with a reduction in wage growth. This is because wage growth is adjusted to move the wage share towards it's equilibrium. If a shock should increase or decrease the actual wage share, the wage growth will adjust to move the wage share towards the equilibrium. The estimated coefficients are -0,087 and represents the speed in which the actual wage share adjusts toward the equilibrium wage share. This is in line with previous literature on Norwegian wage formation, see Bårdsen et al. (2005) and Gjelsvik et al. (2015). However, the coefficients are almost half the size of the coefficients in Bjørnstad and Skjerpen (2006), which implies that the adjustment toward equilibrium is twice as slow. This may imply that coordination through adjustment towards the equilibrium wage share is weaker than previously reported.

TABLE 2: Changes in hourly wages in manufacturing, public and private sector, 1974-2012. Method: fixed effects.

	Primary		Secondary		Vocational		Low univ		High univ	
	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE
Manufacturing										
$(\mathrm{wc}_{m,i} - q - z)_{t-1}$	-.087**	.019	-.087**	.019	-.087**	.019	-.087**	.019	-.087**	.019
u_{t-1}	-.007*	.006	-.007*	.006	-.007*	.006				
$\mathrm{u}_{i,t-1}$									.007	.008
diff									.077**	.047
D_{88-97}									-.002	.005
$\Delta wc_{m,i,t-1}$	.361**	.040	.361**	.040	.361**	.040	.361**	.040	.361**	.040
Δz_t	.177**	.035	.177**	.035	.177**	.035	.177**	.035	.177**	.035
Δh_t	-.283**	.073	-.283**	.073	-.283**	.073	-.283**	.073	-.283**	.073
Δp_t	.653**	.071	.653**	.071	.653**	.071	.741**	.078	.622**	.155
$\mathrm{D}_{wagefreeze}$	-.016**	.004	-.016**	.004	-.016**	.004	-.016**	.004	-.016**	.004
D_{1993}	-.009	.007	-.009	.007	-.009	.007	-.009	.007	-.009	.007
Δu_t	-.030**	.008	-.030**	.008	-.030**	.008	-.029**	.011	-.029**	.011
$\Delta u_{i,t}$							.001	.005	.001	.005
Fixed effect			.015**	.005	.012**	.004	.023	.014	-.529**	.345
Constant	.598**	.126								
Public sector										
$(w_{g,i} - kwa_{g,i})_{t-1}$	-.010	.049	-.010	.049	-.010	.049	-.010	.049	-.010	.049
$u_{i,t-1}$	-.012	.007	-.001	.003	-.001	.003	-.001	.003	-.001	.003
D_{88-97}									-.012**	.002
$\Delta ww_{g,i,t-1}$	-.306**	.083	-.306**	.083	-.306**	.083	-.306**	.083	-.306**	.083
$\Delta kwa_{g,i,t-1}$	.557**	.106	.557**	.106	.557**	.106	.557**	.106	.557**	.106
Δp_t	.432**	.057	.432**	.057	.432**	.057	.432**	.057	.432**	.057
$\Delta u_{i,t}$	-.040**	.002								
Fixed effect			-.026*	.012	-.022	.014	-.025	.016	-.026	.018
Constant	.052*	.022								
Private services										
$(\mathrm{w}_{s,i} - kwa_{s,i})_{t-1}$	-.087**	.032	-.087**	.032	-.087**	.032	-.087**	.032	-.087**	.032
$\Delta ww_{s,i,t-1}$	.262**	.044	.262**	.044	.262**	.044	.262**	.044	.262**	.044
$\Delta kwa_{s,i,t-1}$	.669**	.046	.669**	.046	.669**	.046	.669**	.046	.669**	.046
$\Delta^2 p_t$	.213**	.012	.213**	.012	.213**	.012	.213**	.012	.213**	.012
$\Delta u_{,t}$	-.009	.010	-.009	.010	-.009	.010	-.009	.010	-.009	.010
$\Delta u_{i,t}$							-.005	.004	-.005	.004
Fixed effect			.008**	.002	.004	.002	.013**	.004	.011**	.003
Constant	.019*	.008								

* p<0.05, ** p<0.01

The coefficients on the reference wage-terms in the public and private services ($(w_{g,i}-kwa_{g,i})_{t-1}$ and $(w_{s,i}-kwa_{s,i})_{t-1}$) are also restricted to be equal for all educational groups, and the estimated effects are negative. The results for public and private sector are presented in the first rows of the middle and lower part of table (2) respectively. Negative effects imply that wage growth declines if hourly wages in the sector increases relative to the reference wage. Conversely, wage growth increases if hourly wages are reduced relative to the reference wage. This is the error-correction instrument ensuring that wages in these sectors adjusts to move hourly wages toward the equilibrium share of the reference wage. The estimated coefficient in the public sector is smaller than in Bjørnstad and Skjerpen (2006), implying that adjustment toward the equilibrium is slower than previously reported. This indicates reduced coordination in this sector. In private services, the coefficient is estimated to be larger, implying increased coordination.

The other long term effects in the wage relations is the level of general and education-specific unemployment last period. The effect of the level of general unemployment (u_{t-1}) is estimated for the three lowest educational groups in manufacturing and assumed to be zero for the other groups. The results are presented in the second row of coefficients in table (2). The coefficients are negative as an increase in unemployment reduces wage growth. The results imply that a one percent increase in general unemployment leads to a 0,007 percent decrease in wage growth. The estimated effect is one third of the effect in Bjørnstad and Skjerpen (2006), implying that general unemployment has a lower effect on wage growth than previously reported. The level of education-specific unemployment ($u_{i,t-1}$) is estimated for the two highest educational groups in manufacturing and all groups in public sector, but seems to have no significant effect on wage growth. In Bjørnstad and Skjerpen (2006) the estimated effects were small, but significant at -0,010 for the two groups in manufacturing and -0,016 in public sector.

In manufacturing, the short term effects in the wage relations, including the effects of changes in wage costs ($\Delta wc_{m,i,t-1}$), productivity (Δz_t)and consumer prices (Δp_t), are similar to the effects in Bjørnstad and Skjerpen (2006). The effect of changes in normal working hours (Δh_t) is smaller, and so is the wage-wage effect capturing the difference between wage costs in manufacturing last period and in public sector two periods ago ($diff = wc_{mit-1}-wc_{git-2}$). A change in general unemployment has a larger effect on the three lowest educational groups relative to the top groups, which indicates that the top groups are less affected by general unemployment. However the difference is small. The estimated effect of changes in general unemployment is larger than in Bjørnstad and Skjerpen (2006).

In public sector, the short term effects of changes in reference wage ($\Delta kwa_{g,i,t-1}$) and consumer prices (Δp_t) are similar to the effects in Bjørnstad and Skjerpen (2006). However, the coefficient on changes in hourly wages last period ($\Delta ww_{g,i,t-1}$) is ten times larger. This indicates that wage growth last year affects this year's wage growth more than previously reported. The effect of a change in education-specific unemployment is estimated only for the lowest educational group and is therefore expected not to have an effect on wage growth for the other groups. The coefficient is larger than in Bjørnstad and Skjerpen (2006), implying that the effect is stronger.

The short term effects in the wage relations for private services is similar to the effects reported in Bjørnstad and Skjerpen (2006). However, the estimated short term effects of general and education-specific unemployment (Δu_t and $\Delta u_{i,t}$) seem to have no significant effect on wage growth in table (2).

Different factors may explain why the results differ from the results in table B1 in Bjørnstad and Skjerpen (2006). The data set is longer and there has been some retroactive changes in the data set. First, new data for the whole population is collected for the period 2000-2012 and the old data set before 1997 is used to prolong the variables back in time. As an example, the national accounts implemented a new international standard for classification of industries in 2011, see Solholm et al. (2014). Several industries were split up into smaller industries. Industry number 85, production of services, was spilt into 84; information and communication technology, 85; production of services, and 86; real estate. The new data set has undergone several major revisions, compared to the old data set. Especially, new industries have been added, and historical data on general unemployment was changed in 2006 when fifteen year old persons where included in the data material.

To investigate the effects of a longer time period and the revisions of the data set, the model is estimated on the same sample period as Bjørnstad and Skjerpen (2006), and the results are presented in appendix B. When comparing the results in appendix B to the results in Bjørnstad and Skjerpen (2006), the long term dynamics have similar estimated effects. The estimated effects of the levels of unemployment are not significant, but the estimated effects are numerically similar to the results in Bjørnstad and Skjerpen (2006). And despite the fact that the coefficients on changes in productivity in manufacturing are three times as large in appendix B, the overall results are more similar to the results in Bjørnstad and Skjerpen (2006) on the short sample. This implies that the revisions of the data set has not fundamentally changed the wage relations.

By comparing the results on the long sample in table (2) to the results on a shorter sample in appendix B, it is clear that choice of estimation period affects the size of the estimated coefficients.

The estimated effects of the long term dynamics are smaller in the results on the long sample. In manufacturing, the estimated coefficient on the wage share-term is smaller and the estimated effects of the reference wage-term in public sector is 1/10 of the estimated effect on the short sample. The estimated effect the reference wage-term in private services is similar to the results in the shorter sample. The estimated effects of general unemployment in manufacturing is 1/4. The results in appendix B show no significant effects of unemployment, except for the short term dynamics of education-specific unemployment for the lowest educational group in public sector. The coefficient on changes in productivity in manufacturing is half the size of the estimated effect on the shorter sample. The results on the other short term dynamics differ less between the estimations on the two sample periods, but there are differences in the results.

The long term dynamics on the short sample period have similar estimated effects as in Bjørnstad and Skjerpen (2006), but the effects are different on the longer sample period. Large incidents such as the transition to inflation targeting in 2001 and a surge in immigration in 2004 have changed the Norwegian economy, and may imply that the specification and restrictions in Bjørnstad and Skjerpen (2006) no longer holds. This may be the reason for the low estimated effects of the error-correction-term. This is investigated in the next sections.

7.2 Estimating wage relations with SUR

The estimation of wage relations with seemingly unrelated regression is conducted with full heterogeneity for the educational groups. Full heterogeneity allows for individual effects of each variable for each educational group in all sectors. The SUR method is used to account for the potential correlation between the error terms of the equations for each educational group within a sector. The correlation coefficients reported in appendix C, in the lower part of table (8), (9) and (10), show that there is strong correlation between the error terms of the two highest educational groups and the three lowest educational groups in all sectors.

All variables are included in the equation for each group, except dummies and $diffun$, which is a wage-wage effect assumed only to affect those in the top educational group. Following Gjelsvik et al. (2015), a variable measuring immigration flow in percent is included to capture the effect of a surge in immigration from 2004. The variable is not transformed to logarithmic scale as the logarithm is only defined for positive numbers (Hill et al. (2012) p.142). Results are presented in table (3), while the complete table of results are reported in appendix C.

The specification of the model is thoroughly investigated as this serves as the basis for estimat-

ing new wage relations. The F-test indicates that the explained variance relative to the unexplained variance is sufficiently good. The RSS is reported to be 0,00 and 0,01 for the equations, and this indicates a tight fit. The estimated MSS is between 0,03 and 0,06, and indicate relatively low variance in the modelled values. The root-mean-square-error, RMSE, is low, indicating small difference between the estimated values and the actual values in the data. The R^2 is reported to be over 0,9 for most of the equations, indicating that more than 90 percent of the variation in growth of hourly wages is explained by the model. The estimated values of the Durbin Watson test are close to 2, which indicates no autocorrelation, and the Breusch-Pagan test rejects heteroscedasticity. Hence, the tests show that the fit of the model is satisfactory and rejects heteroscedasticity and autocorrelation in the error terms. The model is rich and will be reduced to attain more precise estimates.

7.2.1 Reducing the model

The model is reduced by imposing restrictions on the full heterogenous model, either by assuming that the variables have equal or no effect on the wage growth. Imposing equal coefficients is considered less strict than omitting variables and this procedure is therefore conducted first. Some of the estimated coefficients in table (3) are equal across educational groups. To simplify the model, restricting coefficients across educational groups to be equal is evaluated by an F-test.

As an example, the estimated coefficients on the wage share-term ($(wc_{m,i} - q - z)_{t-1}$) in manufacturing differ with a numerical value of only 0,03 for all groups except for the top educational group. The null-hypothesis of equal coefficients is not rejected by data. This means that there is no significant difference in the speed in which the four lowest educational groups move towards the equilibrium wage share, although their equilibrium wage shares are different. The top educational group seems to experience a significantly lower effect, implying that coordination through adjustment towards the equilibrium wage share, is lower for this group.

In manufacturing, the estimated coefficients on the level of general unemployment are equal for the two lowest groups, and the test shows that the null hypothesis of equal coefficients can not be rejected. Hence, they are restricted to be equal. Similarly, the coefficients are restricted to be equal for the two top groups. The estimated coefficients on education-specific unemployment are restricted to be equal for the two lowest groups and for the three highest groups respectively. No restrictions are imposed on the coefficients of immigration, but restrictions are imposed on the

TABLE 3: Wage relations with full heterogeneity, SUR-estimation.

Manufacturing	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
Wage share$_{i,t-1}$	-0.12	0.05	-0.15	0.05	-0.14	0.05	-0.13	0.04	-0.04	0.06
u_{t-1}	0.02	0.02	0.02	0.03	-0.04	0.03	0.01	0.01	-0.00	0.02
$u_{i,t-1}$	-0.04	0.02	-0.03	0.02	0.03	0.02	-0.00	0.01	-0.00	0.01
$\Delta wc_{m,i,t-1}$	0.26	0.09	0.32	0.07	0.34	0.10	0.34	0.08	0.54	0.19
Δz_t	0.05	0.07	0.14	0.07	0.20	0.10	0.17	0.08	0.35	0.08
Δh_t	-0.45	0.16	-0.31	0.15	-0.45	0.19	-0.23	0.16	-0.05	0.18
Δp_t	0.41	0.16	0.76	0.13	0.86	0.18	0.82	0.16	0.90	0.18
$D_{wage\ freeze}$	-0.02	0.01	-0.01	0.01	-0.01	0.01	-0.02	0.01	0.01	0.01
Δu_t	-0.01	0.03	0.01	0.03	-0.04	0.04	-0.02	0.02	-0.05	0.02
$\Delta u_{i,t-1}$	-0.01	0.02	-0.03	0.02	0.00	0.02	-0.00	0.01	-0.01	0.01
Immigration	-0.01	0.01	0.00	0.01	0.01	0.02	-0.01	0.01	-0.02	0.01
diffun									-0.21	0.15
Constant	0.86	0.33	1.02	0.31	0.96	0.34	0.90	0.31	0.45	0.37
Public	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{g,i} - kwa_{g,i})_{t-1}$	0.02	0.17	-0.36	0.11	-0.00	0.07	-0.09	0.25	-0.16	0.10
$u_{i,t-1}$	-0.05	0.02	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
$\Delta ww_{g,i,t-1}$	-0.29	0.20	-0.31	0.08	-0.15	0.14	-0.06	0.23	-0.49	0.13
$\Delta kwa_{g,i,t-1}$	0.17	0.23	0.50	0.11	0.41	0.16	0.39	0.22	0.79	0.17
Δp_t	0.16	0.20	0.79	0.12	0.65	0.12	0.51	0.18	0.61	0.19
Δu_{it}	-0.04	0.01	-0.03	0.01	-0.01	0.01	-0.01	0.01	0.01	0.01
Immigration	-0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.01	-0.01	0.01
Constant	0.16	0.05	-0.04	0.03	-0.00	0.02	-0.01	0.06	-0.02	0.03
Private	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{s,i} - kwa_{s,i})_{t-1}$	-0.33	0.12	-0.10	0.08	-0.12	0.06	-0.16	0.08	-0.21	0.06
$u_{i,t-1}$	0.01	0.01	0.00	0.01	-0.00	0.01	0.00	0.00	0.01	0.00
$\Delta ww_{s,i,t-1}$	0.04	0.07	0.11	0.10	0.30	0.10	0.24	0.08	0.44	0.10
$\Delta kwa_{s,i,t}$	0.81	0.05	0.81	0.08	0.76	0.12	0.73	0.07	0.55	0.08
$\Delta^2 p_t$	0.17	0.08	0.11	0.12	0.22	0.13	0.16	0.09	0.14	0.12
Δu_t	-0.05	0.02	-0.03	0.02	-0.05	0.03	-0.02	0.01	-0.03	0.01
Δu_{it}	0.07	0.01	0.04	0.02	0.03	0.02	-0.01	0.01	0.00	0.00
Immigration	-0.02	0.00	0.00	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
Constant	-0.01	0.02	0.01	0.01	0.00	0.01	0.02	0.01	0.02	0.01

coefficients of the short term variables[2].

In public sector, the estimated coefficients on the reference wage-terms are almost equal for the two top groups and the restriction is not rejected by data. The estimated effects for workers with primary and vocational education are not significant and the numeric value is close to zero. The estimated coefficient of workers with secondary education is significantly different from the estimated coefficient of the top educational groups. This indicates that adjustment toward the equilibrium reference wage is slower for the top educational groups, and therefore a shock to the reference wage share would have a smaller impact on wage growth. The estimated coefficients on education-specific unemployment are restricted to be equal for the four top educational groups, and similar restrictions are imposed on the coefficients of the short term variables[3].

In private services, there is no significant difference in the estimated effect of the reference wage-term between the educational groups. This means that all educational groups move in the same speed toward the equilibrium share of the reference wage, although the equilibrium share, as previously mentioned, may differ. The estimated coefficients on education-specific unemployment are restricted to be equal for the two lowest and the two top educational groups respectively, and similar restrictions are imposed on the coefficients of the short term variables[4].

Given these new restrictions, the size and significance of the estimated coefficients is reviewed. This is the second step in the procedure of reducing the model. If the null hypothesis of no effect can not be rejected, the variable is omitted from the equation.

In manufacturing, the estimated effects of the level of general unemployment previous period are close to zero for all groups and is not significant. The null-hypothesis of no effect is tested

[2]The estimated effects changes in wage costs are restricted to be equal for the four lowest groups, changes in productivity are restricted to be equal for the three middle groups, changes in normal working hours are restricted to be equal for the four lowest groups, changes in consumer prices are restricted to be equal for the four top groups, changes in general unemployment are restricted to be equal for all groups, changes in education specific unemployment are restricted to be equal for the two top groups, and the dummy for wage freeze is restricted to be equal for the four lowest educational groups.

[3]The estimated effects of changes in hourly wages are restricted to be equal for the two lowest groups, changes in reference wage are restricted to be equal for the three middle groups, changes in consumer prices are restricted to be equal for the three top groups and changes in general unemployment is restricted to be equal for all groups.

[4]The estimated effects of changes in hourly wages are restricted to be equal for the two lowest groups and for the three top groups respectively. The estimated effects of changes in reference wage are restricted to be equal for the four lowest groups, the effect of the second derivative of consumer prices are restricted to be equal for the three top groups and changes in general unemployment and education specific education are restricted to be equal for all groups.

and can not be rejected, and the variable is omitted from the equations. General and education-specific unemployment is closely correlated, therefore only one of the variables is included also in the short-term part of the equation. Changes in education-specific unemployment is omitted, and changes in general unemployment is kept in the equation as the estimated effects are larger and more significant.

Likewise, the wage-wage-effect and the dummy for 1993 is omitted. The change in productivity is omitted from the equation for workers with primary education, and changes in normal working hours is omitted for the top educational group in manufacturing.

In public sector and private services, the estimated effect of changes in education specific education is omitted together with several dummies. After imposing new restrictions and omitting the variables that do not have significant effects on growth in hourly wages, a new specification of the wage relations emerge.

7.2.2 Wage relations

The simplified wage relations are presented in table (4). As before, the estimated coefficients of the pattern bargaining model, the wage share-terms and reference wage-terms, are all negative. In manufacturing, the interpretation is that if a shock should increase/decrease actual wage share above/below the equilibrium wage share the wage growth will decrease/increase until the wage share reaches it's equilibrium. A shock to productivity, producer prices or directly on wages would change the actual wage share away from it's equilibrium, and the negative effects of the wage share-term ensures that wage growth will adjust to move the wage share back towards it's equilibrium. The estimated effect is -0,17 for the four lowest groups, as presented in the first line in table (4). For the top educational group the estimated effect is -0,10, implying that this group has a slower adjustment toward the equilibrium wage share. This means that wages in the top educational group can deviate from the equilibrium wage share for a longer time period compared to the other groups.

In the other sectors, the estimated negative effect of the reference wage-terms implies error-correction towards a reference wage. If the equilibrium relationship between wages is 90 percent, this means that hourly wage growth adjusts so that wages in this sector amounts to 90 percent of the reference wage. Note however, that the reference wage consists of both wages in the two other sectors and of unemployment benefits received by the unemployed. Wages and unemployment benefits are weighted by the unemployment rate. The interpretation of the long run relationship is that the wage growth will adjust towards equilibrium as a response to a sector-specific shock. As

TABLE 4: Changes in hourly wages in manufacturing, public and private sector. SUR-estimation.

Manufacturing	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
Wage share$_{i,t-1}$	-0.18	0.03	-0.18	0.03	-0.18	0.03	-0.18	0.03	-0.10	0.03
$u_{i,t-1}$	-0.02	0.01	-0.01	0.01	-0.00	0.00	0.00	0.00	0.00	0.00
$\Delta wc_{m,i,t-1}$	0.28	0.06	0.28	0.06	0.28	0.06	0.27	0.07	0.24	0.08
Δz_t			0.11	0.04	0.11	0.04	0.11	0.04	0.25	0.05
Δh_t	-0.31	0.10	-0.31	0.10	-0.31	0.10	-0.31	0.10		
Δp_t	0.78	0.13	0.94	0.10	0.94	0.10	0.94	0.10	0.94	0.10
Δu_t	-0.04	0.01	-0.04	0.01	-0.04	0.01	-0.04	0.01	-0.04	0.01
Immigration	-0.02	0.01	-0.00	0.01	-0.01	0.01	-0.01	0.01	-0.02	0.01
Constant	1.23	0.21	1.23	0.22	1.21	0.22	1.27	0.22	0.71	0.19
Public	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{g,i} - kwa_{g,i})_{t-1}$	-0.09	0.10	-0.41	0.08	0.03	0.05	-0.17	0.08	-0.17	0.08
$u_{i,t-1}$	-0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\Delta ww_{g,i,t-1}$	-0.30	0.06	-0.30	0.06	-0.18	0.08	-0.11	0.10	-0.41	0.12
$\Delta kwa_{g,i,t-1}$	0.30	0.16	0.43	0.08	0.43	0.08	0.43	0.08	0.71	0.14
Δp_t	0.37	0.18	0.80	0.09	0.55	0.08	0.55	0.08	0.55	0.08
Constant	0.10	0.04	-0.04	0.01	0.02	0.01	-0.02	0.02	-0.02	0.02
Private	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{s,i} - kwa_{s,i})_{t-1}$	-0.15	0.03	-0.15	0.03	-0.15	0.03	-0.15	0.03	-0.15	0.03
$u_{i,t-1}$	-0.00	0.01	-0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00
$\Delta ww_{s,i,t-1}$	0.15	0.07	0.15	0.07	0.34	0.05	0.34	0.05	0.34	0.05
$\Delta kwa_{s,i,t}$	0.68	0.04	0.68	0.04	0.68	0.04	0.68	0.04	0.58	0.08
$\Delta^2 p_t$	0.18	0.06	0.18	0.06	0.18	0.06	0.18	0.06	0.18	0.06
Δu_t	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
Immigration	-0.01	0.01	-0.00	0.01	-0.02	0.01	-0.00	0.01	-0.01	0.01
Constant	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01
N	39									

seen in first row of the middle panel in table (4), the estimated elasticity in public sector is -0,17 for the two top educational groups, and significantly higher in the group of workers with secondary education where it is -0,41. This means that the actual wage share in the two top groups can deviate from the equilibrium wage share longer, compared to the group of workers with shorter education. The estimated effects of the groups of workers with primary and vocational education is still not significant.

In the private services, presented in the bottom panel of table (4), the estimated coefficient on the reference wage-term is -0,10 for all groups. Hence a sector-specific shock would affect wage growth equally across educational groups.

The effects of the level of education-specific unemployment ($u_{i,t-1}$) are negative in all sectors, indicating that an increase in unemployment is associated with a decrease in wage growth for each educational group. The effects are numerically small and barely significant, but they are part of the long term dynamics shaping wage growth in the long run, see Gjelsvik et al. (2015). In the long run, changes in unemployment affects the incentives to coordinate and may lead to a higher or lower degree of coordination. Higher equilibrium levels of unemployment can be due to a shift in the wage curve in section 3.2, figure (1). Hence, the variable is an important part of the wage relations, and is included in all sectors although the estimated effects are not significant and the numerical value is close to zero.

Immigration is the last of the long-term variables in the equations. The estimated effects of immigration are not significant, but following Gjelsvik et al. (2015) they are included in the long term dynamics. The estimated effects are negative, indicating that an increase in immigration reduces wage growth. This may imply that the bargaining power of unions are reduced, but that there is not enough observations in the data set to obtain significant results. The estimated negative effect is in line with basic theory of labour supply and demand. An increase in the supply of labor would lead to a outward shift in the supply curve, causing unemployment to increase, for a given level of demand unless wages decline.

A decrease in normal working hours (Δh_t) is estimated to increase wage growth with an estimated elasticity of 0,31. A decrease in normal working hours imply that each worker supply less labour, and hence the supply decreases and the pressure on wage growth increases. The effect is opposite to the effect described above with increased immigration. However, normal working hours are politically determined and have not changed since 1987 when it was changed from 40 to 37,5 hours per week. If normal working hours were changed to six hours per day, 30 hours per week, the

estimated elasticity indicate a 0,62 percent increase in hourly wages, all else equal. The estimated effect is equal across educational groups in manufacturing, but there is no estimated effect for the top group. This may be because this group includes managers and other long education-professions which do not adhere to normal working hours.

The short term dynamics in manufacturing are changes in productivity, working hours, consumer prices and in hourly wages previous period. The coefficient on changes in hourly wages ($\Delta wc_{m,i,t-1}$) is 0,27 for the three lowest educational groups, implying that a one percent increase in this variable is estimated to increase the wage growth with 0,27 percent. This means that growth in hourly wages is associated with further growth. The estimated effects are lower for the two top groups, with 0,25 for the workers with low university education, and 0,21 for workers in the top group.

A one percent increase in changes in productivity (Δz_t) is estimated to increase wage growth with 0,09 percent for the three middle educational groups, 0,24 for the top group, and no effect on the lowest educational group. The estimated short term effect for the top group is more than 2,5 times larger than for the middle groups. However, this is short term effects, while the long term effects of productivity is captured in the wage share-term discussed above. Hence, productivity affects wage growth also in the lowest educational group in the long run. The variable capturing changes in productivity is not education specific, but general across all groups. There may be differences in the growth in productivity across the groups and this aggregation may affect the results, but there is not available data on education-specific productivity.

A one percent increase in changes in consumer prices (Δp_t) is associated with a 0,87 percent increase in wage growth for all groups in manufacturing. This elasticity is high and indicates that a one percent increase in consumer prices leads to a close to one percent, 0,87 percent, increase in wages. Hence, workers are immediately almost fully compensated for changes in inflation. Following Calmfors and Larsson Seim (2013), the wage leader internalizes the effect on prices of wages in all sectors.

A one percent increase in changes in general unemployment (Δu_t) is estimated to decrease wage growth with 0,04 percent for all educational groups. The terms capturing unemployment may also capture other elements of the economic situation, as unemployment is a key indicator of the business cycles, see Sparrman (2012). Low unemployment normally coincides with high economic activity and high unemployment coincides with low activity. Okuns law describe this inverse relationship between unemployment and gross domestic product, see Cuaresma (2003).

The short term dynamics in public sector are changes in hourly wages, the reference wage and the consumer price index, and these are presented in the second panel of table (4). An increase in wage growth last year ($\Delta ww_{g,i,t-1}$) is associated with a reduction in wage growth this year. The estimated effect is largest for the top educational group where a one percent increase in wage growth last year is associated with a 0,40 percent decrease in wage growth. The estimated effects differ across groups and are significantly smaller for workers with vocational and lower university education. These educational groups include teachers and nurses which is a large share of public employed workers.

An increase in growth in the reference wage ($\Delta kwa_{g,i,t-1}$) in public sector is associated with an increase in wage growth. This means that growth in wages in the other sectors coincides with growth in wages in this sector, and this underpins the long term effect of the reference wage-term. The estimated positive effect of changes in the reference wage is largest in the top educational group with an elasticity of 0,71. This might be because workers with high university education have a greater mobility between sectors than other groups, hence wages adjust more rapidly to short term changes in the reference wage to prevent the workers from leaving public sector.

Changes in consumer prices (Δp_t) in public sector, leads to an increase in hourly wages, and the estimated elasticity is 0,55 for the top three educational groups. The estimated effect is lower for workers with primary education and higher for workers with secondary education. The estimated coefficient must be regarded in conjunction with the effect in manufacturing due to pattern bargaining. Changes in consumer prices, in addition to having a direct effect on wage growth in the sector, have an indirect effect through the reference wage. An increase in consumer prises increases wage growth in manufacturing, which increases the reference wage in the other sectors. Hence, the total effect of changes in consumer prices is the estimated effect plus the indirect effect.

The short term dynamics in private services are changes in hourly wages, the reference wage, consumer prices, and changes in general unemployment. An increase in wage growth last year ($\Delta ww_{s,i,t-1}$) is associated with an increase in growth of hourly wages, as in manufacturing. The estimated elasticity is 0,33 for the top three educational groups and 0,20 for the two lowest educational groups.

An increase in growth in the reference wage ($\Delta kwa_{s,i,t-1}$) is associated with an increase in hourly wage growth, as in public sector. The estimated effect is 0,57 for the top group and 0,65 for all other groups. Again, the top group may have a higher effect because it includes more managers with fixed wages and because workers with high university education may be more mobile.

The estimated effect of changes in general unemployment (Δu_{t-1}) is negative, implying that an increase in the growth of unemployment reduces wage growth. This estimated short term effect is equal across the educational groups. A one percent increase in growth of unemployment would lead to a 0,01 percent decrease in wage growth, or a 100 percent increase in the growth of unemployment would lead to a one percent decrease in wage growth. This is in line with the theory illustrated in figure (1) in section 3.2, where following the wage curve, an increase in relative unemployment reduces relative wages.

7.3 Wage relations with coordination

Calmfors and Driffill (1988) and others have shown that the degree of coordination in wage setting matters for wage growth, and indicators of coordination, by Kenworthy (2001) and others, show that Norway has a high degree of coordination compared to other countries. The wage share-term in the wage equations capture one element of coordination as the equilibrium wage share is determined by bargaining power, and that the error-correction form ensures that wage growth is adjusted to move the wage share towards it's equilibrium. Likewise, the reference wage-terms capture an element of coordination as the relationship between wages and reference wage is determined by bargaining power, and the error-correction form ensures that hourly wages moves towards the equilibrium share of the reference wage. However, elements such as coordination among unions or the degree of conflict between unions and employer organizations are not incorporated in the equations estimated in the previous section. These are captured by the Norwegian coordination index presented in section 4.

To further investigate the effects of coordination on hourly wages, the Norwegian coordination index and an interaction term between coordination and the error-correction-term are added to the wage relations. The interaction term is included to capture the interaction between the coordination index and the wage share-term in manufacturing and reference wage-terms in the other sectors (Hill et al. (2012) p.195). The Norwegian coordination index and an interaction term should capture most of the yearly variation in coordination which is not captured by the wage share-term in manufacturing and the reference wage-terms in public sector and private services.

The coordination index is not transformed to logarithmic scale as it can take the value zero and the logarithm is only defined for positive numbers (Hill et al. (2012) p.142). The interaction variable is the wage share-term ($(wc_{mi} - q - z)_{t-1}$) multiplied with the coordination index ($Coord$). The two multiplied explanatory variables are not independent, and therefore the marginal effect of one variable depend on the level of the other. The effect of coordination on wage growth depends

on the wage share-term and the adjustment towards the equilibrium wage share depends on the level of coordination.

The coordination index captures some of the same information as the dummies. Hence, the dummies are excluded from the equation and the automatic selection procedure described in section 6.5 is applied on the new model. Notably, the number of dummies is lower than without the coordination index, implying that some of the variation is captured by the index.

The results are presented in table (5). In manufacturing and the public sector the estimated coefficients of coordination and the interaction term are significantly different from zero in a joint test for all educational groups. In the private services sector, the estimated coefficients are not significantly different from zero. However, theory by Bårdsen et al. (2005) and Calmfors and Larsson Seim (2013) imply that coordination should affect growth in hourly wages for all groups of workers because wages are determined through wage bargaining. Hence, the terms are kept in the wage relations even though the estimated effects are not significant.

When tested, the null-hypothesis of equal coefficients on coordination for all educational groups in manufacturing, is rejected at a 0,001 level, but the hypothesis of equal coefficients on the four lowest educational groups can not be rejected. Hence, the coordination-term may have the same effect on hourly wages for the workers in the four lowest groups, but the highest group have a higher estimated effect. The total effect of coordination is derived by taking the derivative of the wage equation with respect to the coordination-variable. Therefore, the coefficients on coordination and the wage share-term must be considered in combination with the estimated effect of the interaction term between the two variables. The effect of the coordination-variable on growth in hourly wages equals the estimated coefficient on this variable plus the estimated coefficient on the interaction term multiplied by the value of the wage share-term (Hill et al. (2012) p.195).

The total estimated coefficient of coordination for workers with primary education in manufacturing is -0,012 in 1990 ($-0,41+0,06*6,63=-0,012$), while it is -0,016 in year 2000 and 2010. For workers with high university education in manufacturing the estimated effect in 1990 is 0,015 ($-0,57+0,08*7,31=0,015$), while it is 0,006 in 2000 and 0,007 in 2010. A larger estimated coefficient of coordination is counteracted by the larger wage share, and the result is that the top educational group end up with a positive effect of coordination on wage growth. The positive sign indicates that an increase in coordination increases wage growth for the top educational group, while it decreases wage growth for the lowest educational group. The numerical difference between the estimated effects are small, but the interpretation of different signs on the estimated coefficients

TABLE 5: Wage relations with coordination for manufacturing, public and private sector.

Manufacturing	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
Wage share$_{i,t-1}$	-0.37	0.14	-0.37	0.14	-0.37	0.14	-0.37	0.14	-0.40	0.08
$u_{i,t-1}$	-0.01	0.01	-0.01	0.01	-0.00	0.01	0.01	0.00	0.01	0.00
$\Delta wc_{m,i,t-1}$	0.28	0.07	0.28	0.07	0.28	0.07	0.30	0.07	0.35	0.06
Δh_t	-0.33	0.13	-0.33	0.13	-0.33	0.13	-0.33	0.13		
Δp_t	0.79	0.13	0.94	0.10	0.94	0.10	0.94	0.10	0.94	0.10
Δu_t	-0.04	0.01	-0.04	0.01	-0.04	0.01	-0.04	0.01	-0.04	0.01
Immigration	-0.02	0.01	-0.00	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
Coord	-0.32	0.23	-0.32	0.24	-0.36	0.24	-0.37	0.25	-0.60	0.13
Coord x $ws_{i,t-1}$	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.08	0.02
Δz_t			0.06	0.03	0.06	0.03	0.06	0.03	0.30	0.05
Constant	2.47	0.96	2.52	0.99	2.48	0.98	2.60	1.02	2.95	0.59
Public	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{g,i} - kwa_{g,i})_{t-1}$	-1.65	0.37	-1.37	0.48	-0.26	0.23	-1.87	0.37	-1.87	0.37
$u_{i,t-1}$	0.02	0.02	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
$\Delta ww_{g,i,t-1}$	-0.14	0.10	-0.14	0.10	0.00	0.10	-0.08	0.12	-0.28	0.13
$\Delta kwa_{g,i,t-1}$	0.36	0.17	0.34	0.11	0.34	0.11	0.34	0.11	0.46	0.16
Δp_t	0.95	0.20	0.89	0.14	0.70	0.10	0.70	0.10	0.70	0.10
Coord	0.01	0.00	0.02	0.01	0.02	0.01	0.09	0.02	0.08	0.02
Coord x $ws_{i,t-1}$	0.42	0.10	0.19	0.12	0.10	0.06	0.46	0.10	0.38	0.09
Constant	-0.04	0.05	-0.14	0.06	-0.04	0.04	-0.34	0.07	-0.39	0.08
Private	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{s,i} - kwa_{s,i})_{t-1}$	-0.17	0.15	-0.17	0.15	-0.17	0.15	-0.17	0.15	-0.17	0.15
$u_{i,t-1}$	-0.01	0.01	0.01	0.01	-0.00	0.01	0.01	0.00	0.00	0.00
$\Delta ww_{s,i,t-1}$	0.05	0.09	0.05	0.09	0.33	0.06	0.33	0.06	0.33	0.06
$\Delta kwa_{s,i,t}$	0.66	0.04	0.66	0.04	0.66	0.04	0.66	0.04	0.44	0.08
$\Delta^2 p_t$	0.15	0.07	0.15	0.07	0.15	0.07	0.15	0.07	0.15	0.07
Δu_t	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
Immigration	-0.02	0.01	-0.01	0.01	-0.02	0.01	-0.01	0.01	-0.01	0.01
Coord	0.00	0.00	0.01	0.00	-0.00	0.00	0.00	0.00	-0.00	0.00
Coord x $ws_{i,t-1}$	-0.02	0.06	-0.11	0.05	0.02	0.03	-0.04	0.04	-0.02	0.04
Constant	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.01
N	39									

is interesting. Following Kenworthy (2000) and others, the degree of coordination is high in Norway, but there might be differences between the educational groups. The top educational group is small compared to the groups of workers with vocational or lower university education which traditionally have a high degree of coordination. According to Calmfors and Driffill (1988), there is a hump-shaped relation between centralisation and real wages. If the degree of coordination is sufficiently low in the top educational group, then increased coordination may lead to increased wage growth and an increase in real wages.

Similarly, the effect of the wage share-term on hourly wages equals the estimated coefficient on wage share plus the coefficient on the interaction term times the value of coordination. The estimated coefficients is three times larger than in the model without coordination in table (4). This is because the estimated coefficient now must be interpreted with the interaction term and the level of coordination. For workers with primary education in manufacturing, the estimated coefficient of wage share is -0,42. The estimated total effect of wage growth is $-0,42 + 0,06 * 3,7 = -0,20$, if the degree of coordination is at it's average level of 3,7, for the years 1972 to 2012. This is higher, but close to the estimated effect in table (4). If the degree of coordination is at it's maximum level of 5, the estimated effect is -0,12, so the estimated effect is lower if the degree of coordination is higher. This is because the estimated effect of the interaction term is positive, which is contrary to the expected outcome as coordination is expected to intensify the adjustment toward equilibrium. This can be interpreted a temporary increase in bargaining power in certain settlements or as a decrease in the concern for profitability in the businesses by the wage setters when coordination is extensive.

In manufacturing, the estimated effects of coordination is similar across educational groups. However, the estimated coefficients on coordination and the interaction term combined is larger for the top educational group which may imply that an increase in coordination may lead to a larger reduction in wage growth for the top educational group compared to the others.

In public sector, the estimated coefficients on coordination and the interaction term is positive. This indicates that an increase in coordination raises the growth of hourly wages. However, the reference wage-term is significantly larger than before the coordination index was included in the wage relations. This may imply that this term captures all the negative effect of coordination.

In private sector, the estimated coefficients of coordination is positive, but the estimated coefficient of the interaction term is negative. Hence, the total effect of coordination on wage growth is negative, in line with the theory in section 3.

7.4 Wage relations with five sub-indicators of coordination

The Norwegian coordination index is constructed by use of five sub-indicators. The sub-indicators may have different effects on hourly wages, not visible using the aggregate index, see Barkbu et al. (2001). Sub-indicators may have estimated positive effects for some groups and negative for others, or some sub-indicators may have significant estimated effects where the aggregated index did not. Therefore, the sub-indicators are included as explanatory variables in the equations and the results are presented in table (6) and (7).

In the manufacturing sector, all five sub-indicators have negative effects on growth in hourly wages, and the effects of the different sub-indicators within each educational group are similar. This lends support to using the aggregate coordination index as explanatory variable. The coefficients on the sub-indicators are significantly different from zero in a joint test for all educational groups.

As with the aggregated variable in public sector, the sub-indicators are not significant in the three lowest educational groups. For the two top groups, the estimated coefficients are significantly different from zero, and they are similar across groups. The numerical size of each coefficient is similar to the estimated coefficient on the aggregated variable in previous section. The numerical size of the interaction term is also similar, and this lends support to using the aggregate index as well.

In private services, the estimated effects of the sub-indicators have different signs. This lends support to using the sub-indicators and not the aggregated index. However, not all the sub-indicators seem to have significant results. In the two top educational groups, there are no significant results. In the other groups, the estimated effects of I2 and I5 are significantly different from zero and similar across groups. I2 captures contributions from the government in wage settlements and I5 captures the degree of conflict between unions and employer organisations, where a high value indicate a high degree of conflict. The estimated coefficient on I2 is negative, indicating that an increase in government contribution decreases wage growth. The estimated coefficient on I5 is positive, indicating that less conflict, which implies a higher degree of coordination, increases wage growth, but again, the effect must be seen in conjunction with the interaction term and the reference wage-term.

All in all, the results from using the sub-indicators does not provide much additional information, compared to the results using the aggregated index. However, the sub-indicators measure different aspects of coordination in wage settlements, and following Barkbu et al. (2001) sub-indicators

can be included solely in wage equations to further investigate the separate effects.

8 Conclusion

Calmfors and Driffill (1988) and others have shown that the degree of coordination in wage setting matters for wage growth, and indicators of coordination, by Kenworthy (2001) and others, show that Norway has a high degree of coordination compared to other countries. The wage relations presented in this thesis include coordination and show that Norwegian wage settlements are characterised by a high degree of coordination.

Compared to previous literature, the results in this thesis indicate that error-correction towards the equilibrium wage share or reference wage is somewhat faster than previously reported. By using Bjørnstad and Skjerpen (2006) as a reference point, it is shown that the wage relations for five educational groups have changed over time. By comparing their model on their sample period and a longer sample period it is displayed that the estimated coefficients changes over time. This may be caused by the transition to inflation targeting in 2001 and the surge of immigration from 2004.

The new model is estimated with seemingly unrelated regression (SUR) while the previous model by Bjørnstad and Skjerpen (2006) used fixed effects analysis. Estimation with SUR shows that there is correlation in the error-terms of the five educational groups. The SUR-approach is used to estimate new wage relations, to test previous restrictions and ensure efficient coefficients. The full heterogenous model is rich and is reduced in this thesis to attain more precise estimates.

The wage relations are specified as error-correction equations, implying that wage growth adjusts towards equilibrium in the long run. The error-correction-term in manufacturing is the wage share-term. This capture one element of coordination as the equilibrium wage share is determined by bargaining power, and the error-correction form ensures that wage growth is adjusted to move the wage share towards it's equilibrium. In public and private sector, the reference wage-terms have a similar function capturing an element of coordination. When the model is reduced, the estimation results displays that error-correction towards the equilibrium wage share or reference wage is somewhat faster than previously reported.

When looking at the cross-group effects, the group of workers with high university education differ from the other educational groups in several respects. Especially, the results imply that the wages in the top group can deviate from the equilibrium for a longer period of time than the less educated groups. This indicates that wage growth for this group is determined differently than for

TABLE 6: Wage relations with I1, I2, I3, I4 and I5 for manufacturing and public sector.

Manufacturing	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
Wage share$_{i,t-1}$	-0.41	0.11	-0.41	0.11	-0.41	0.11	-0.41	0.11	-0.38	0.08
$u_{i,t-1}$	-0.02	0.01	-0.00	0.01	-0.00	0.01	0.01	0.01	0.01	0.01
$\Delta wc_{m,i,t-1}$	0.23	0.07	0.23	0.07	0.23	0.07	0.25	0.07	0.27	0.07
Δh_t	-0.13	0.13	-0.13	0.13	-0.13	0.13	-0.13	0.13		
Δp_t	0.89	0.15	1.05	0.10	1.05	0.10	1.05	0.10	1.05	0.10
Δu_t	-0.03	0.01	-0.03	0.01	-0.03	0.01	-0.03	0.01	-0.03	0.01
Immigration	-0.01	0.01	0.01	0.01	0.00	0.01	-0.00	0.01	-0.00	0.01
I1	-0.46	0.18	-0.47	0.19	-0.48	0.19	-0.53	0.20	-0.57	0.14
I2	-0.46	0.18	-0.48	0.19	-0.48	0.19	-0.55	0.20	-0.58	0.14
I3	-0.44	0.18	-0.47	0.18	-0.47	0.18	-0.53	0.20	-0.60	0.14
I4	-0.40	0.18	-0.43	0.19	-0.43	0.19	-0.50	0.20	-0.58	0.14
I5	-0.43	0.18	-0.45	0.18	-0.45	0.18	-0.52	0.19	-0.58	0.14
Coord x $ws_{i,t-1}$	0.07	0.03	0.07	0.03	0.07	0.03	0.07	0.03	0.08	0.02
Δz_t			0.12	0.04	0.12	0.04	0.12	0.04	0.35	0.06
Constant	2.75	0.72	2.79	0.74	2.76	0.73	2.89	0.77	2.79	0.58

Public	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{g,i} - kwa_{g,i})_{t-1}$	-1.68	0.40	-0.92	0.49	-0.15	0.25	-1.91	0.39	-1.91	0.39
$u_{i,t-1}$	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\Delta ww_{g,i,t-1}$	-0.06	0.10	-0.06	0.10	0.05	0.10	0.03	0.11	-0.25	0.13
$\Delta kwa_{g,i,t-1}$	0.24	0.17	0.23	0.11	0.23	0.11	0.23	0.11	0.36	0.15
Δp_t	0.98	0.21	0.83	0.17	0.74	0.10	0.74	0.10	0.74	0.10
I1	-0.01	0.02	0.01	0.02	0.00	0.02	0.05	0.02	0.09	0.02
I2	-0.00	0.01	-0.01	0.02	-0.00	0.01	0.05	0.02	0.08	0.02
I3	-0.03	0.03	0.01	0.03	0.03	0.02	0.08	0.03	0.07	0.03
I4	0.04	0.03	-0.01	0.04	0.00	0.02	0.10	0.03	0.09	0.03
I5	0.02	0.02	-0.01	0.02	0.02	0.02	0.10	0.02	0.08	0.02
Coord x $ws_{i,t-1}$	0.41	0.11	0.04	0.12	0.06	0.06	0.41	0.10	0.38	0.09
Constant	-0.03	0.05	-0.09	0.06	-0.02	0.04	-0.34	0.08	-0.40	0.09

TABLE 7: Wage relations with I1, I2, I3, I4 and I5 for private services sector.

Private	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{s,i} - kwa_{s,i})_{t-1}$	-0.22	0.15	-0.22	0.15	-0.22	0.15	-0.22	0.15	-0.22	0.15
$u_{i,t-1}$	-0.00	0.01	0.02	0.01	-0.00	0.00	0.01	0.00	0.00	0.00
$\Delta ww_{s,i,t-1}$	0.06	0.09	0.06	0.09	0.30	0.06	0.30	0.06	0.30	0.06
$\Delta kwa_{s,i,t}$	0.64	0.05	0.64	0.05	0.64	0.05	0.64	0.05	0.47	0.08
$\Delta^2 p_t$	0.18	0.07	0.18	0.07	0.18	0.07	0.18	0.07	0.18	0.07
Δu_t	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
Immigration	-0.03	0.01	-0.01	0.01	-0.02	0.01	-0.02	0.01	-0.01	0.01
I1	-0.01	0.01	-0.01	0.01	-0.01	0.01	0.00	0.01	-0.01	0.01
I2	-0.02	0.01	-0.00	0.01	-0.02	0.01	0.00	0.01	-0.01	0.01
I3	0.02	0.02	0.01	0.02	0.00	0.02	-0.01	0.02	0.00	0.02
I4	-0.01	0.02	-0.00	0.02	-0.02	0.02	0.01	0.02	-0.00	0.02
I5	0.01	0.01	0.04	0.01	0.02	0.01	0.01	0.01	0.00	0.01
Coord x $ws_{i,t-1}$	-0.03	0.06	-0.13	0.05	0.03	0.04	-0.03	0.04	-0.01	0.04
Constant	0.04	0.02	0.03	0.02	0.04	0.02	0.03	0.02	0.04	0.01
N	39									

other groups, and may have implications for the bargaining power of this group. As this group increases relative to the other groups it may have implications for the degree of coordination in Norwegian wage formation.

Immigration is found to affect wage growth negatively, implying that the increase in immigration reduces growth in hourly wages. The estimated effects of changes in consumer prices imply that workers are almost fully compensated for changes in inflation. Changes in productivity has a 2,5 times larger estimated effect for the top group than for the middle groups i manufacturing, while workers with primary education seems to have no short term effect of changes in productivity on wage growth.

The high degree of coordination is accounted for by including the Norwegian coordination index in the wage relations. The five sub-indicators of the index have similar estimated effects on wage growth, and hence the effect of the aggregated index is representative. Coordination affects hourly wages negatively, and the total effect differ across educational groups. Contrary to the expected outcome, the estimated total effect of error-correction is lower if the degree of coordination is high. This result can be interpreted as a temporary increase in bargaining power in settlements with a higher than average degree of coordination, or as a decrease in the concern for profitability in the businesses by wage setters when coordination is extensive.

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Appendix

A Data

Data on hourly wages by industry with homogenous labour is provided by the Unit for National Accounts at Statistics Norway. It is disaggregated into five educational groups:
- Primary education (GRK) - less than 11 years of formal education
- Secondary education (VA) - 11-12 years of formal education
- Vocational education (VF) - 11-12 years of formal education
- Low university education (HO) - 13-16 years of formal education
- High university education (UN) - 17 yeas or more of formal education

Data on industry level is aggregated into the three sectors Manufacturing, Public sector and Private services. Manufacturing is sector 3a include industry 15, 25, 30 and 45, Public sector is sector 90 containing industry 92S, 91S and 90K, and Private services is sector 5 containing industry 55, 63, 66, 68, 71, 72, 74, 81, 84, 85 and 86 in MODAG, see Boug and Dyvi (2008).

Data for all variables are provided by the Unit for National Accounts at Statistics Norway unless other source is specified. Data on unemployment (UR) is included by sector and educational group, as well as total unemployment corrected for a change in measurement from 2006 (URKORR).

Data on normal working hours (ARBTID) is normal working hours in public sector. Data on immigration (ABRUTTOINNV12) is gross immigration from country-group 1 and 2. This variable is extended backwards with the value of 1978 from 1977 to 1972 because of missing data. Data on oil price (OLJEPRIS) is from the last updated MODAG. Data on the development of oil price, or price trend, (PYF64) is from the National Accounts before the publishing of 2014 numbers. Data on productivity in manufacturing (ZQL3a) is assumed to be constant across educational groups because of availability of data. Data on reference wage (KWA), also called alternative wage, is by sector 90 and 5 and is corrected for unemployment. Included is also data on the producer price index in manufacturing (PYF3a) and the consumer price index (KPI). The variables are transformed to logarithmic scale, and lower case letters indicate log variables.

Data on coordination in wage settlements (CoordHaraBark) is a merge between the coordination index from chapter 4 for the years 1990 to 2012 and the index by Barkbu (2000) for the years 1972 to 1989.

B Empirical results fixed effects estimation 1972-1997

	Primary		Secondary		Vocational		Low univ		High univ	
	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE
Manufacturing										
$(\mathrm{wc}_{m,i} - q - z)_{t-1}$	-.101**	.026	-.101**	.026	-.101**	.026	-.101**	.026	-.101**	.026
u_{t-1}	-.026	.016	-.026	.016	-.026	.016				
$\mathrm{u}_{i,t-1}$									-.001	.005
diff									.082**	.018
D_{88-97}									-.013**	.005
$\Delta wc_{m,i,t-1}$	.306**	.038	.306**	.038	.306**	.038	.306**	.038	.306**	.038
Δz_t	.388**	.068	.388**	.068	.388**	.068	.388**	.068	.388**	.068
Δh_t	-.222*	.096	-.222*	.096	-.222*	.096	-.222*	.096	-.222*	.096
Δp_t	.452*	.180	.452*	.180	.452*	.180	.730**	.054	.439**	.079
$\mathrm{D}_{wagefreeze}$	-.030**	.007	-.030**	.007	-.030**	.007	-.030**	.007	-.030**	.007
D_{1993}	-.007	.006	-.007	.006	-.007	.006	-.007	.006	-.007	.006
Δu_t	.000	.010	.000	.010	.000	.010	.001	.011	-.001	.011
$\Delta u_{i,t}$							.001	.005	.001	.005
D_{1975}	.018**	.004	.018**	.003						
D_{1978}					.046**	.011				
D_{1991}			.030**	.003						
D_{1992}			-.047**	.003						
Fixed effect			.015**	.005	.012**	.003	-.007	.028	-.579**	.155
Constant	.719**	.183								
Public sector										
$(w_{g,i} - kwa_{g,i})_{t-1}$	-.123	.075	-.123	.075	-.123	.075	-.123	.075	-.123	.075
$u_{i,t-1}$	-.010	.007	.007	.005	.007	.005	.007	.005	.007	.005
D_{88-97}									-.004	.003
$\Delta ww_{g,i,t-1}$	-.202*	.090	-.202*	.090	-.202*	.090	-.202*	.090	-.202*	.090
$\Delta kwa_{g,i,t-1}$	.454**	.113	.454**	.113	.454**	.113	.454**	.113	.454**	.113
Δp_t	.678**	.080	.678**	.080	.678**	.080	.678**	.080	.678**	.080
$\Delta u_{i,t}$	-.035**	.002								
D_{1975}	.029**	.004	.029**	.004	029**	.004	.029**	.004	.029**	.004
D_{1976}	.038**	.003	.038**	.004	.044**	.006				
D_{1979}	-.041**	.003							-.021**	.005
D_{1982}					.036**	.004	.041**	.003		
D_{1988}			-.031**	.003	-.043**	.004	-.018**	.002		
Fixed effect			-.038**	.011	-.042**	.016	-.043*	.020	-.038	.022
Constant	.050*	.024								

* p<0.05, ** p<0.01

	Primary		Secondary		Vocational		Low univ		High univ	
	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE
Private services										
$(w_{s,i} - kwa_{s,i})_{t-1}$	-.087*	.035	-.087*	.035	-.087*	.035	-.087*	.035	-.087*	.035
$\Delta w_{s,i,t-1}$	.233**	.067	.233**	.067	.233**	.067	.233**	.067	.233**	.067
$\Delta kwa_{s,i,t-1}$	.687**	.045	.687**	.045	.687**	.045	.687**	.045	.687**	.045
$\Delta^2 p_t$	.249**	.042	.249**	.042	.249**	.042	.249**	.042	.249**	.042
$\Delta u_{,t}$	.005	.011	.005	.011	.005	.011	.005	.011	.005	.011
$\Delta u_{i,t}$							-.004	.004	-.004	.004
D_{1978}	.033**	.002								
D_{1982}	.027**	.001								
D_{1987}					.026**	.001				
D_{1993}			-.015**	.002	-.025**	.002	-.024**	.001	-.033**	.001
Fixed effect			.007**	.002	.005	.004	.013**	.004	.012**	.002
Constant	.020**	.008								

* p<0.05, ** p<0.01

C SUR-estimation with full heterogeneity, 1972-2012

Table (8), (9) and (10) display the results from estimating the model with full heterogeneity between the five educational groups. This is done to evaluate whether the restrictions imposed by Bjørnstad and Skjerpen (2006) still holds. As will be seen, the restrictions and specification of the model is changed to better fit the data.

The estimation results presented in this section is the basis for new wage relations, and therefore measures of fit are reported in the tables. The F-test indicates that the explained variance relative to the unexplained variance is good. The residual sum of squares, RSS, measures the discrepancy between the model and the data, and therefore a low value implies a tight fit of the model. The RSS is reported to be 0,00 and 0,01 for the equations, and this indicates a tight fit. The model sum of squares, MSS, reports how well the model represents the data by how many fewer errors is made when using the regression model in stead of the data mean. The estimated MSS is between 0,03 and 0,06, and indicate relatively low variance in the modelled values. The root-mean-square-error, RMSE, measure the difference between the estimated values and the actual values in the data, and this is reported to be low. R^2 reports the proportion of total variation in the dependent variable that is explained by the model. The R^2 is reported to be over 0,9 for most of the equations, indicating that more than 90 percent of the variation in growth of hourly wages is explained by the model. The

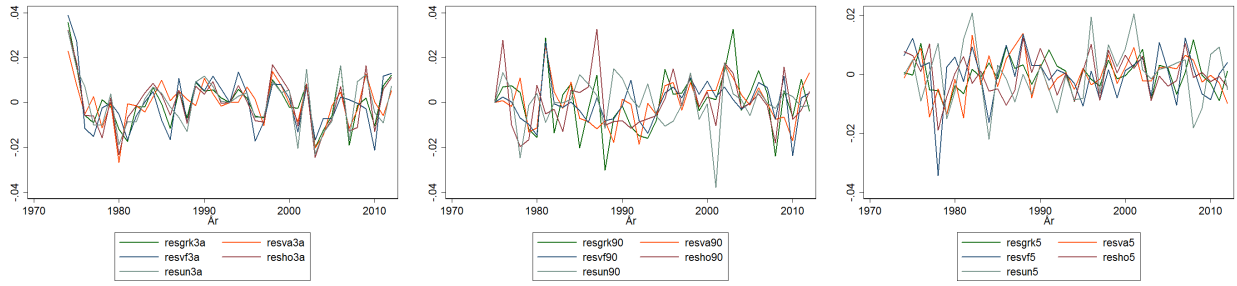

FIGURE 6: Plot of the residuals in manufacturing (left), public sector (middle) and private services (right).

Durbin Watson test is a test of autocorrelation in the residuals. The estimated values are close to 2, which indicates no autocorrelation. The Breusch-Pagan test is used to test for heteroscedasticity. It computes a Chi^2 estimate with 10 degrees of freedom.

Figure (6) shows plots of the residuals. The residuals vary around zero, indicating no autocorrelation, and the educational groups vary together. The residuals are the difference between the actual value and the estimated value of the dependent variable. The fit is best in manufacturing.

TABLE 8: Wage relations for manufacturing, SUR-estimation.

Manufacturing	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
Wage share$_{i,t-1}$	-0.12	0.05	-0.15	0.05	-0.14	0.05	-0.13	0.04	-0.04	0.06
u_{t-1}	0.02	0.02	0.02	0.03	-0.04	0.03	0.01	0.01	-0.00	0.02
$u_{i,t-1}$	-0.04	0.02	-0.03	0.02	0.03	0.02	-0.00	0.01	-0.00	0.01
diffun									-0.21	0.15
$\Delta wc_{m,i,t-1}$	0.26	0.09	0.32	0.07	0.34	0.10	0.34	0.08	0.54	0.19
Δz_t	0.05	0.07	0.14	0.07	0.20	0.10	0.17	0.08	0.35	0.08
Δh_t	-0.45	0.16	-0.31	0.15	-0.45	0.19	-0.23	0.16	-0.05	0.18
Δp_t	0.41	0.16	0.76	0.13	0.86	0.18	0.82	0.16	0.90	0.18
$D_{wage\ freeze}$	-0.02	0.01	-0.01	0.01	-0.01	0.01	-0.02	0.01	0.01	0.01
Δu_t	-0.01	0.03	0.01	0.03	-0.04	0.04	-0.02	0.02	-0.05	0.02
$\Delta u_{i,t-1}$	-0.01	0.02	-0.03	0.02	0.00	0.02	-0.00	0.01	-0.01	0.01
Immigration	-0.01	0.01	0.00	0.01	0.01	0.02	-0.01	0.01	-0.02	0.01
D_{1975}	0.02	0.01	0.02	0.01						
D_{1978}					0.05	0.02				
$D_{1988-1997}$									-0.01	0.01
D_{1991}			0.03	0.01						
D_{1992}			-0.04	0.01						
D_{1993}	-0.02	0.01	0.00	0.01	-0.01	0.02	-0.01	0.01	0.00	0.02
D_{2003}					-0.01	0.01				
D_{2008}	-0.03	0.01	-0.07	0.01						
Constant	0.86	0.33	1.02	0.31	0.96	0.34	0.90	0.31	0.45	0.37
Years	39.00									
F-test	25.04		26.07		18.10		21.99		18.39	
RSS	0.00		0.00		0.01		0.01		0.01	
MSS	0.05		0.05		0.06		0.04		0.05	
RMSE	0.01		0.01		0.02		0.01		0.01	
R^2	0.92		0.94		0.90		0.89		0.90	
Durbin Watson	1.46									
Breusch-Pagan	136.95(10.00)									

Correlation matrix of residuals					
	D.wwgrk3a	D.wwva3a	D.wwvf3a	D.wwho3a	D.wwun3a
D.wwgrk3a	1.00				
D.wwva3a	0.58	1.00			
D.wwvf3a	0.64	0.22	1.00		
D.wwho3a	0.65	0.70	0.58	1.00	
D.wwun3a	0.60	0.63	0.51	0.67	1.00

TABLE 9: Wage relations for public sector, SUR-estimation.

Public	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{g,i} - kwa_{g,i})_{t-1}$	0.02	0.17	-0.36	0.11	-0.00	0.07	-0.09	0.25	-0.16	0.10
$u_{i,t-1}$	-0.05	0.02	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
$\Delta ww_{g,i,t-1}$	-0.29	0.20	-0.31	0.08	-0.15	0.14	-0.06	0.23	-0.49	0.13
$\Delta kwa_{g,i,t-1}$	0.17	0.23	0.50	0.11	0.41	0.16	0.39	0.22	0.79	0.17
Δp_t	0.16	0.20	0.79	0.12	0.65	0.12	0.51	0.18	0.61	0.19
Δu_{it}	-0.04	0.01	-0.03	0.01	-0.01	0.01	-0.01	0.01	0.01	0.01
Immigration	-0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.01	-0.01	0.01
D_{1975}	0.03	0.02	0.03	0.01	0.03	0.01	0.04	0.02	0.05	0.02
D_{1976}	0.05	0.02	0.04	0.01	0.05	0.01				
D_{1979}	-0.05	0.02							-0.02	0.02
D_{1982}					0.04	0.01	0.05	0.02		
D_{1988}			-0.03	0.01	-0.04	0.01	-0.02	0.01		
$D_{1988-1997}$									-0.01	0.01
D_{2001}	0.01	0.02	-0.00	0.01	0.01	0.01	0.03	0.01		
D_{2008}			0.08	0.01	0.02	0.01			-0.07	0.02
D_{2009}									0.03	0.01
Constant	0.16	0.05	-0.04	0.03	-0.00	0.02	-0.01	0.06	-0.02	0.03
Years	38.00									
F-test	15.33		36.28		28.70		17.32		18.70	
RSS	0.01		0.00		0.00		0.01		0.00	
MSS	0.04		0.05		0.04		0.03		0.04	
RMSE	0.02		0.01		0.01		0.01		0.01	
R^2	0.86		0.93		0.93		0.87		0.90	
Durbin Watson	2.10									
Breusch-Pagan	30.86(10.00)									

Correlation matrix of residuals					
	D.wwgrk90	D.wwva90	D.wwvf90	D.wwho90	D.wwun90
D.wwgrk90	1.00				
D.wwva90	0.44	1.00			
D.wwvf90	0.42	0.50	1.00		
D.wwho90	0.25	0.09	0.15	1.00	
D.wwun90	-0.03	-0.16	-0.08	0.25	1.00

TABLE 10: Wage relations for private services, SUR-estimation.

Private	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{s,i} - kwa_{s,i})_{t-1}$	-0.33	0.12	-0.10	0.08	-0.12	0.06	-0.16	0.08	-0.21	0.06
$u_{i,t-1}$	0.01	0.01	0.00	0.01	-0.00	0.01	0.00	0.00	0.01	0.00
$\Delta ww_{s,i,t-1}$	0.04	0.07	0.11	0.10	0.30	0.10	0.24	0.08	0.44	0.10
$\Delta kwa_{s,i,t}$	0.81	0.05	0.81	0.08	0.76	0.12	0.73	0.07	0.55	0.08
$\Delta^2 p_t$	0.17	0.08	0.11	0.12	0.22	0.13	0.16	0.09	0.14	0.12
Δu_t	-0.05	0.02	-0.03	0.02	-0.05	0.03	-0.02	0.01	-0.03	0.01
Δu_{it}	0.07	0.01	0.04	0.02	0.03	0.02	-0.01	0.01	0.00	0.00
Immigration	-0.02	0.00	0.00	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
D_{1978}	0.02	0.01								
D_{1982}	0.02	0.01								
D_{1987}					0.02	0.01				
D_{1993}			0.00	0.01	-0.00	0.01	-0.00	0.01	-0.02	0.01
D_{2007}									0.02	0.01
D_{2008}			-0.08	0.01	-0.03	0.01	-0.03	0.01		
D_{2009}			0.04	0.01						
Constant	-0.01	0.02	0.01	0.01	0.00	0.01	0.02	0.01	0.02	0.01
Years	39.00									
F-test	132.53		56.35		41.15		71.17		32.77	
RSS	0.00		0.00		0.00		0.00		0.00	
MSS	0.05		0.04		0.05		0.04		0.04	
RMSE	0.01		0.01		0.01		0.01		0.01	
R^2	0.98		0.96		0.94		0.96		0.92	
Durbin Watson	1.91									
Breusch-Pagan	24.43(10.00)									

Correlation matrix of residuals					
	D.wwgrk5	D.wwva5	D.wwvf5	D.wwho5	D.wwun5
D.wwgrk5	1.00				
D.wwva5	0.45	1.00			
D.wwvf5	0.17	0.21	1.00		
D.wwho5	0.10	0.05	0.49	1.00	
D.wwun5	-0.18	0.09	0.05	0.24	1.00

D SUR-estimation with restrictions on equal coefficients

Manufacturing	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
Wage share$_{i,t-1}$	-0.13	0.03	-0.13	0.03	-0.13	0.03	-0.13	0.03	-0.04	0.05
u_{t-1}	0.01	0.02	0.01	0.02	-0.05	0.03	0.00	0.01	0.00	0.01
$u_{i,t-1}$	-0.03	0.01	-0.01	0.01	0.03	0.02	-0.00	0.01	-0.00	0.01
$\Delta wc_{m,i,t-1}$	0.30	0.06	0.30	0.06	0.30	0.06	0.31	0.08	0.48	0.18
Δz_t	0.07	0.08	0.16	0.06	0.16	0.06	0.16	0.06	0.33	0.08
Δh_t	-0.35	0.14	-0.35	0.14	-0.35	0.14	-0.35	0.14	-0.08	0.18
Δp_t	0.48	0.16	0.80	0.12	0.80	0.12	0.80	0.12	0.80	0.12
Δu_t	-0.03	0.01	-0.03	0.01	-0.03	0.01	-0.03	0.01	-0.03	0.01
$u_{i,t-1}$	0.00	0.01	-0.00	0.01	-0.00	0.01	0.00	0.01	-0.01	0.00
Immigration	-0.02	0.01	0.00	0.01	0.00	0.01	-0.01	0.01	-0.02	0.01
diffun									-0.16	0.14
Constant	0.95	0.23	0.91	0.23	0.93	0.23	0.94	0.24	0.43	0.30

Public	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{g,i} - kwa_{g,i})_{t-1}$	0.01	0.16	-0.41	0.09	-0.02	0.07	-0.17	0.10	-0.17	0.10
$u_{i,t-1}$	-0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$\Delta ww_{g,i,t-1}$	-0.29	0.07	-0.29	0.07	-0.17	0.08	-0.07	0.11	-0.45	0.14
$\Delta kwa_{g,i,t-1}$	0.27	0.17	0.44	0.09	0.44	0.09	0.44	0.09	0.74	0.17
Δp_t	0.33	0.21	0.83	0.10	0.59	0.10	0.59	0.10	0.59	0.10
Δu_{it}	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
Immigration	-0.00	0.02	0.01	0.01	0.01	0.01	0.02	0.01	-0.00	0.01
Constant	0.10	0.05	-0.05	0.02	0.00	0.02	-0.03	0.02	-0.02	0.03

Private	Primary		Secondary		Vocational		Low univ.		High univ.	
	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std	Estimate	Std
$(ww_{s,i} - kwa_{s,i})_{t-1}$	-0.15	0.03	-0.15	0.03	-0.15	0.03	-0.15	0.03	-0.15	0.03
$u_{i,t-1}$	-0.00	0.01	-0.00	0.00	-0.00	0.00	0.01	0.00	0.00	0.00
$\Delta ww_{s,i,t-1}$	0.15	0.07	0.15	0.07	0.35	0.06	0.35	0.06	0.35	0.06
$\Delta kwa_{s,i,t}$	0.68	0.04	0.68	0.04	0.68	0.04	0.68	0.04	0.58	0.08
$\Delta^2 p_t$	0.19	0.06	0.19	0.06	0.19	0.06	0.19	0.06	0.19	0.06
Δu_t	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
Δu_{it}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Immigration	-0.01	0.01	-0.00	0.01	-0.02	0.01	-0.00	0.01	-0.01	0.01
Constant	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01

E Dummy variables from table 2

	Primary		Secondary		Vocational		Low univ		High univ	
	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE	Estmate	SE
Manufacturing										
D_{1975}	.032**	.014	.030**	.014						
D_{1978}					.038**	.014				
D_{1991}			.029**	.013						
D_{1992}			-.047**	.014						
D_{2003}					-.028**	.014				
D_{2008}	-.034**	.013	-.068**	.013						
Public sector										
D_{1975}	.032**	5 .004	.032**	.004	.032**	.004	.032**	.004	.032**	.004
D_{1976}	.034**	.002	.040**	.003	.048**	.006				
D_{1979}	-.053**	.002							-.039**	.003
D_{1982}					.046**	.002	.046**	.004		
D_{1988}			-.030**	.003	-.048**	.005	-.023**	.002		
D_{2001}	.051**	.001	.037**	.001	.045**	.002	.047**	.002		
D_{2008}			.069**	.001						
D_{2009}									.046**	.004
Private services										
D_{1978}	.034**	.002								
D_{1982}	.029**	.001								
D_{1987}					.028**	.002				
D_{1993}			-.015**	.001	-.024**	.001	-.024**	.001	-.032**	.001
D_{2007}									.034**	.003
D_{2008}			-.067**	.002	-.025**	.001	-.042**	.001		
D_{2009}			.042**	.004					-.039**	.003

* p<0.05, ** p<0.01

F Main participants and abbreviations

The overall value of the coordination index in the period 1990 to 2014 is presented in section 5. Tree appendixes describes the coordination index in further debt. The main participants and abbreviations in Norwegian wage settlements are presented in this section. The coordination index consist of five sub-indicators, and these sub-indicators are documented in detail in appendix G. Appendix H contains the evaluation of each of sub-indicator for every year from 1990 to 2014.

Unions

LO: The Norwegian Confederation of Trade Unions

YS: The Confederation of Vocational Unions

A: The Federation of Norwegian Professional Associations, called Academics, former AF

Unio: The main organization for university and college graduates, former UHO

Employer organizations

NHO: Confederation of Norwegian Enterprise, former NAF

HSH/Virke: the Enterprise Federation of Norway

KS: The Norwegian Association of Local and Regional Authorities

NAVO/Spekter: The Employers Association Spekter

Abbreviations

AF: Akademikernes fellesorganisasjon: Academics Council.

AFP: Avtalefestet pensjon: Contractual pension

BNL: The Federation of Norwegian Construction Industries, member of NHO

DNMF: Det norske maskinistforbund, member of Unio

EL IT: EL og IT: The Electrician and IT workers union, member of LO

Farma: Farmasiforbundet: The Association of Pharmacy Technicians, member of YS

FF: Fellesforbundet, member of LO

FO: Fellesorg. for barnevernspedagoger, sosionomer og vernepleiere: Norwegian Union of Social Educators and Social Workers, member of LO

HK: Handel og Kontor, member of LO

HUK: Samarbeid om helse, utdanning og kultur: Cooperation on health, education and culture area

KAH: Kommuneansattes Hovedsammenslutning: Municipal Employees' confederation

MBL: Mediebedriftenes landsforening: Media Businesses' Association

NAL: Norske arkitekters landsforbund: National Association of Norwegian Architects, member of LO

NAVO: Norges Arbeidsgiverforening for Virksomheter med Offentlig Tilknytning: Norwegian Employers' Association for Enterprises with Public Sector Affiliations

NB: Norges Bondelag: The Norwegian Farmers' Union

NBL: Nngsmiddelbedriftenes landsforening, now NHO mat og drikke: NHO food and beverage, member of NHO

NBS: Norsk Bonde- og Smukarlag: Norwegian Farmers and Smallholders Union

NFF: Norges Farmaceutiske Forening: The Norwegian Association of Pharmacists

NGF: Norsk Grafisk Forbund, now Fellesforbundet, FF, member of LO

NHS: Norsk Helse og sosialforbund, now Fagforbundet: Norwegian Union of Municipal and General Employees, member of LO

NISO: Idrettsutvernes fagforbund: Sports Practitioners union

NJ: Norsk journalistlag: The Norwegian Union of Journalists

NL: Norsk lrlag, now Utdanningsforbundet: Union of Education Norway, member of Unio

NNN: Norsk Nngs- og Nytelsesmiddelarbeiderforbund: Norwegian Food and Allied Workers Union, member of LO

NRF: Norsk Radiografforbund: The Norwegian Society of Radiographers

NSA: Norges rederiforbund: The Norwegian Shipowners' Association

NSF: Norsk Sykepleierforbund: The Norwegian Nurses Organisation

NSOF: Norsk Sjoffisersforbund: The Norwegian Maritime Officers Association

NSU: Norsk Sjmannsforbund: Norwegian Seafarers' Union

NTF: Norsk transportarbeiderforbund: The Norwegian Transport Workers Union, member of LO

OFS/SAFE: Oljearbeidernes Fellessammenslutning, now SAFE, member of YS

OLF: Oljeindustriens landsforening, now, Norsk olje og gass: The Norwegian Oil and Gas Association

PRIFO: Privatansattes Fellesorganisasjon, now Parat, member of YS

RL: Rederienes Landsforening, now NHO Sjfart: The Federation of Norwegian Coastal Shipping, member of NHO

RM: Riksmeklingsmannen: State Mediator

SAMFO: Arbeidsgiverforening for samvirkeforetak

TBL: Teknologibedriftenes landsforening: Federation of Norwegian Manufacturing Industries, member of NHO

TBU: Teknisk beregningsutvalg: the Technical Reporting Committee

TD: Tele- og Dataforbundet, now EL og IT Forbundet: The Electrician and IT workers union, member of LO

TELFO: Tekniske Entreprenrers Landsforening, now Norsk Teknologi: Norwegian technology, member of NHO

TL: Transportbedriftenes Landsforening, now NHO Transport, member of NHO

UHO: Utdanningsgruppenes Hovedorganisasjon, now UNIO: The main organization for university and college graduates

Visko: Visuell Kommunikasjon Norge, member of NHO

YTF: Yrkestrafikkforbundet, member of YS

G Sub-indicators

The coordination index consists of five sub-indicators. The sub-indicators can take values between zero and one, and the sum make up the overall coordination for one particular year. The sub-indicators measure different aspects of coordination. The first sub-indicator capture the organization of the wage settlements and the degree of centralisation. The second sub-indicator reflects government contribution in the settlements in manufacturing and private services beyond the usual. The third and fourth sub-indicators reflect coordination between the unions, and between the employer organisations, respectively. The last sub-indicator reflects the coordination between the unions and the employer organisations.

G.1 Organization

I1 reflects the organisation of wage settlements. The indicator can take values [0,1] and is determined by whether organisations follows the order of negotiations according to the Aukrust model and whether settlements are conducted coordinated or union respectively. If the organisations follow the order of negotiations according to the Aukrust model, this gives value 1. This implies that organisations in the manufacturing sector negotiate first. The private service sector follows and at last the public sector negotiates. See the Aukrust model and specification of this in chapter five of The econometrics of Macroeconomic modelling by Bårdsen et al. (2005).

If the settlements are conducted coordinated at the peak or national level, this gives value 1. If the settlements are conducted on industry or sector level, this gives value 0. In Norway there are main settlements every second year where the Collective Agreement is negotiated. In main

settlements, bargaining in private services is mainly conducted on industry or sector level. In the public sector, both in the state and the municipalities, the settlements are always conducted at the peak or national level. Before the end of the 1st year of the agreement, negotiations are held between the government and the confederations about wage adjustments for the 2nd year Lovdata (2015b). In intermediate settlements the bargaining in the private sector are mainly conducted at the peak or national level.

The value of the indicator is determined by the average value of the order, the type of settlement in the public sector and the type of settlement in the private sector. The indicator can take values [0,1], but will in most cases take the values 0.67 or 1. This is because the organizations largely follow the order of the Aukrust model, and that the settlements in the public sector are always implemented at the peak or national level. This means that it is whether settlements in manufacturing and private sector are conducted on industry or sector level, or the peak or national level, that gives variation in the indicator. In some cases, the LO/NHO area have bargaining at the peak or national level in the main settlement, while the rest of the private sector has bargaining at the industry or sector level.

The sub-indicator can take values between 0 and 1:

- 1 = coordinated settlements where the order of negotiations is according to the Aukrust model
- 0 = Industry or union specific settlements where the order is not according to the model

G.2 Government contributions in private sector settlements

I2 reflects government contributions in wage settlements in the private sector. The government may call a joint meeting, initiate a working group, change monetary policy, change tax rates, change laws and policies, send letters to the parties or clarify their policy in other ways. Government policy changes are considered as contributions solely when they are made conditional on the organizations actions in the bargaining. The indicator can take values [0,1]. If government contribution in addition to the framework of the settlements is essential for the agreement in the private sector the indicator value is 1. If additional government contribution is less important to the agreement the value is 0.7. If there is no additional government contribution the value is 0,5. If there is no government contribution the indicator takes the value 0. This can happen if the framework of wage settlements with tripartite concertation is ended by the government.

New collective agreements are negotiated every second year in the main settlements. The two year Collective Agreements regulate employee and employer rights and responsibilities. In

intermediate settlements wage regulation is negotiated. Other policy issues may also be negotiated if it is agreed upon in the main settlement.

The sub-indicator can take values between 0 and 1:

- 1 = government interference was essential in making the parties come to an agreement
- 0.5 = government interference was less important
- 0 = no government interference

G.3 The employee side

I3 reflects the extent of coordination on the employee side. The indicator can take values [0,1], and the value is determined by the number of organisations with common requirements relative to the number of organisations. This variable will also reflect whether organisations that choose to exercise moderation can feel confident that other organisations also will present moderate wage demands. The unions can typically agree on wage demands, requirements relating to collective agreements at the main settlement, and requirements in other policy areas in intermediate settlements. The indicator measures the degree of agreement between the organizations. All included agreements are weighted equally.

The sub-indicator can take values between 0 and 1:

- 1 = All organisations with common requirements
- 0 = No organisations with common requirements

G.4 The employer side

I4 reflects the extent of coordination on the employer side. The indicator can take values [0,1], and the value is determined by the number of organisations with a common policy relative to the number of organisations. The indicator is similar to I3 for employer organisations.

The sub-indicator can take values between 0 and 1:

- 1 = All organisations with common requirements and countermeasures
- 0 = No organisations with common requirements and countermeasures

G.5 Conflict

I5 is an indicator of the overall bargaining climate, and reflects the climate of cooperation between employers and employees. All the negotiations referred to in the reports of the Technical Reporting Committee (TBU) take a value [0,1] by degree of conflict. In coordinated settlements the LO/NHO

area, the public sector including the state and municipalities, and the rest of the negotiations are weighted with an equal 1/3 each. In settlements where the LO/NHO area has negotiations on the industry or sector level, mainly in intermediate settlements, all negotiations are weighted equally. The weights are decided on the basis of how many people are affected by negotiation outcomes.

The lowest level of conflict is agreement between the parties in the negotiations, which gives the value 1. Next level of conflict is agreement on a second offer after the ballot has declined the first offer, which gives the value 0.75. If the parties reach an agreement after mediation or strike the value will be 0.5. If agreement is reached after multiple rounds of mediation or strike the value will be 0.25. If the parties are unable to agree and there is voluntary or compulsory arbitration the value will be 0.

In the 2-year period of the Collective Agreement there is a peace duty. This means that employees cannot strike and the employers cannot use lockout. In the Intermediate settlements there is however a possibility of using strikes and lockout Lovdata (2015a). If the parties do not reach an agreement by negotiation, the parties may terminate the Collective Agreement within 14 days after the end of negotiations and with 14 days' notice Lovdata (2015b).

The sub-indicator can take values between 0 and 1:

- 1 = agreement
- 0.75 = agreement on second offer
- 0.5 = break and possibly strike prior to agreement on the sketch from the State Mediator
- 0.25 = break and possibly strike prior to several rounds of offers from the State Mediator
- 0 = compulsory arbitration

H Technical appendix: coordination index for the each year

The purpose of this appendix is to document the construction of indicators for coordination of wage formation in Norway. The indicators will be used to analyse the effect of coordination of wage formation on the wage of various educational groups. There is an extensive international literature on the effect of coordination of wage determination. The indicator variables in this index are based on the coordination index by Barkbu (2000), but are modified to be more exact and reliable. The indicator values are based on a review of wage settlements in Norway from 1990 to 2012. The main source is the reports from the Technical Reporting Committee on Income Settlements (TBU).

1990

In 1990 it was main settlements for most wage earners. The tariff negotiations were the first normal negotiations after two years of income and dividend regulation (NOU 1992: 4 p.66). The negotiations were conducted coordinated with industry-level customizations. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organizations.

1990		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 1 State and municipal: 1 The order of the Aukrust model: 1	1
I2	No government contribution:0	0,5
I3	Agreeing on demands in public service sector: LO,YS,AF/LO,YS,AF = 1	1
I4	Agreeing on low price growth: NHO,HSH,KS,staten/NHO,HSH,KS,staten = 1	1
I5	LO/NHO: 0,25, State: 0,5, Municipal: 0,5, YS/NHO: 1, HK/HSH: 1, Transport: 0,25, Bank and insurance: 1,NJ/NRK, NAL: 0,25, OFS/OLF: 0, Police: 0 Coordinated settlement: (0,25+0,5+(3,5/7))/3=0,42	0,42
Sum		3,92

(NOU 1992: 4, s.66-68) (Stokke,1998, s.339-346)

1991

In 1991 it was intermediate settlements with a revision of the wage rates in the two year collective agreements from 1990. Negotiations were conducted coordinated with industry-level customizations. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organizations.

1991		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 1 State and municipal: 1 The order of the Aukrust model: 1	1
I2	Compensation to sailors for loss of deduction: 1	0,7
I3	Agreeing on wage demands: LO,YS,AF/LO,YS,AF = 1	1
I4	Agreeing on low price growth: NHO,HSH,KS,staten/NHO,HSH,KS,staten = 1	1
I5	LO/NHO: 0,5, State: 1, Municipal: 1, YS/NHO: 0,5, NSOF/NHO: 0,5, HK/HSH: 0,5, Bank and insurance: 0,5. Coordinated settlement: (0,5+1+0,5)/3 = 0,67	0,67
Sum		4,37

(NOU 1992: 4, s.68-70)

1992

In 1992 it was main settlements for most wage earners. The negotiations were conducted coordinated with industry-level customizations. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organisations.

1992		Weighted average
I1	LO/NHO: 1 YS/NHO, LO/HSH: 0 State and municipal: 1 The order of the Aukrust model: 1	0,75
I2	Letter from the Prime Minister on reforms for families: 1 Employment Committee (Sysselsettingsutvalget) launched the Solidarity Alternative: 1	1
I3	Agreeing to change AFP: LO,YS,AF/LO,YS,AF = 1 Agreeing on RMs sketch in the municipality: YS,AF/LO,YS,AF = 0,67	0,84
I4	Agreeing to change AFP: NHO,HSH,KS,state/NHO,HSH,KS,state = 1	1
I5	LO/NHO: 0,5, State: 0,5, AF,YS (without NHF)/KS: 0,5, LO, NHF/KS: 0, YTF: 0, NSOF/NHO: 0,5, DNMF/NHO: 0, HK/HSH: enighet: 1. Coordinated settlement: (0,5+0,67+0,38)/3 = 0,5	0,5
Sum		4,09

(Stokke, 1998, s.346-355), (NOU 1994: 5)

1993

In 1993 it was intermediate settlements with a revision of the wage rates in the two year collective agreements from 1992. Negotiations were conducted coordinated with industry-level customizations. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organizations.

1993		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 1 State and municipal: 1 The order of the Aukrust model: 1	1
I2	Letter on state co-financing of AFP: 1 Established a commission on the transition from employment to retirement: 1	1
I3	Agreeing on AFP: LO,YS,AF/LO,YS,AF = 1	1
I4	Agreeing on AFP: NHO,HSH,KS,state/NHO,HSH,KS,state = 1	1
I5	LO/NHO: 0,5, State: 1, Municipal: 1, YS/NHO: 0,5, HK/HSH: 1, Bank and insurance: 1 Coordinated settlement: (0,5+1+(2,5/3))/3 = 0,78	0,78
Sum		4,78

(NOU 1995:7, s.76-78)

1994

According to the usual pattern it was main revision for most tariff areas in 1994. For the first time since 1986 the main revision in the LO/NHO area were conducted by industry-level bargaining. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organizations.

1994		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 0 State and municipal: 1 The order of the Aukrust model: 1	0,67
I2	Letter on state co-financing of 40 percent of AFP costs: 0,7	0,7
I3	Agreeing on AFP: LO,YS,AF/LO,YS,AF = 1	1
I4	Agreeing on AFP: NHO,HSH,KS,state/NHO,HSH,KS,state = 1	1
I5	FF/TBL: 0,5, Hotels and resturants: 0,5, Office and warehouse employees: 0,5, NTF/TL: 0,25, Tobacco: 0,25, HK/HSH: 0,25, Bank and insurance1: 0,25, OFS/OLF: 0, State: 1, Municipal: 1, Police/stat: 0, AF/KS: 0 5,25/12= 0,44	0,44
Sum		3,88

(NOU 1995:7, s.78-81)

1995

In 1995 it was intermediate settlements with a revision of the wage rates in the two year collective agreements from 1994. Negotiations were conducted coordinated with industry-level customizations.

LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organizations.

1995		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 1 State and municipal: 1 The order of the Aukrust model: 1	1
I2	No additional government contribution: 0,5	0,5
I3	Agreeing on low-wage profile: (LO,YS,AF)/(LO,YS,AF) = 1 Agreeing on the proposal from the State: (LO,YS)/(LO,YS,AF) = 0,67. AF broke off the negotiations.	0,84
I4	Agreeing on low-wage profile: (NHO,HSH,KS,staten)/(NHO,HSH,KS,staten) = 1	1
I5	LO/NHO: 0,5, State: 1, Municipal: 1, Police/state: 0, AF/state and municipal: 0, NL/KS: 0,25, YS/NHO:,5, HK/HSH: 1, Bank and insurance: 0,5 Coordinated settlement: (0,5+(2,25/5)+(2/3))/3 = 0,54	0,54
	Sum	3,88

(NOU 1996:4, s.81-82)

1996

According to the usual pattern it was main revision for most tariff areas in 1996. In the manufacturing sector and the private service sector the settlements were conducted by bargaining on industry level. The contractual pension (AFP), continuing education and the solidarity alternative were important issues in the negotiations. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organizations.

1996		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 0 State and municipal: 1 The order of the Aukrust model: 1	0,67
I2	Principles for a new law on Labour Disputes, NOU 1996:14: 0,7	0,7
I3	Agreeing on AFP, continuing education and equal pay: 1 Agreeing on settlement with State and municipal: 1	1
I4	Agreeing to continue the Solidarity Alternative: 1	1
I5	FF/TBL: 0,25, HK/NHO: 0,5, Hotel and restaurant: 0,25, HK/HSH: 1, State: 1, Municipal: 1. (0,25+0,5+0,25+1+1+1)/6= 0,67	0,67
	Sum	4,04

(NOU 1997:13, s.88-90)

1997

In most areas there were signed two-year Collective agreements in 1996 with access to negotiate wage adjustments in 1997. Negotiations were conducted coordinated with industry-level customizations. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organisations.

1997		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 1 State and municipal: 1 The order of the Aukrust model: 1	1
I2	Letters and initiative to establish a commission on early retirement: 0,7	0,7
I3	Common requirements on early retirement:1 Agreeing on settlement with state and municipal: 1	1
I4	Agreeing on early retirement and AFP: 1	1
I5	LO/NHO: 0,5, State: 0,5, Municipal: 0,5, YS/NHO: 0,5, HK/HSH: 1 Coordinated settlement: (0,5+0,5+(1,5/2))/3 = 0,58	0,58
	Sum	4,28

(NOU 1998:2, s.95-98)

1998

In 1998 it was main revision for most tariff areas. In the manufacturing sector and the private service sector the settlements were conducted by bargaining on industry level. Continuing education, apprenticeship schemes and contractual pension (AFP) were key issues in the negotiations. LO, NB and the Norwegian Fishermen's Association were represented as unions in TBU. NHO and the government were represented as employer organisations.

1998		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 0 State and municipal: 1 The order of the Aukrust model: 1	0,67
I2	Letters on continuing education, the apprenticeship system and contractual pension (AFP) to LO and NHO contributed to agreement: 0,7	0,7
I3	Agreeing on continuing education, the apprenticeship system and AFP: = 1 Agreeing on RMs proposal in state: (LO,YS,A)/(LO,YS,AF,A) = 0,75. AF did not recommend the proposal and put members on strike. Agreeing on RMs proposal in municipal: (LO,A)/(LO,YS,AF,A) = 0,5. AF and Norsk Helse- og Sosialforbund (YS) and Maskinistforbundet (YS) did not recommend the proposal and put members on strike.	0,75
I4	Disagreement between NHO and HSH: 0,5 (Barkbu,2000)	1
I5	Verkstedoverenkomsten, building trades and hotels: 0,5, HK/HSH, bank and insurance: 1, Drivers: 0,25, LO,YS,A/state: 0,5, AF/state: 0, NHS/KS: 0, NSF,NRF and NITO/KS: 0, LO/TD: 0, NAVO/Telenor: 0, (0,5+1+0,25+0,5)/9=0,25	0,25
	Sum	4,28

(NOU 1999:12, s.107-112)

1999

In most areas there were signed two-year Collective agreements in 1998 with access to negotiate wage adjustments in 1999. Negotiations were conducted coordinated with industry-level customizations. TBU was reappointed for the period 1999-2003. The Commission was extended with AF, Academics and YS on the employee side and with HSH and KS on the employer side. Of the former members NB/NBS and Norwegian Fishermen left the Commission.

1999		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 1 State and municipal: 1 The order of the Aukrust model: 1	1
I2	The Arntsen Commission and letter to LO/NHO about the reform on competence:0,7	0,7
I3	Common demands on the reform on competence: 1	1
I4	Agreeing on the report from The Arntsen Commission: 1	1
I5	LO/NHO: 0,5, LO, YS, AF/KS: 0,5, YS/NHO: 0,5, LO/HSH: 0,5 Coordinated settlement: 0,5	0,5
	Sum	4,2

(NOU 2000:4, s.110-118)

2000

In 2000 it was time for main revision for most tariff areas. Only in the YS/NHO area negotiations were conducted by bargaining on industry level. The reform on competence was a key topic of negotiation and the parties agreed to establish a commission to study how a support for subsistence during educational leave should be designed. In 2000, LO, YS, AF and Academics were represented as unions in TBU. NHO, HSH, KS and the state were represented as employer organisations.

2000		Weighted average
I1	YS/NHO: 0, LO/NHO, LO/HSH: 1 State and municipal: 1 The order of the Aukrust model: 1	0,75
I2	Letter from the Prime Minister to LO/NHO on livelihood support under educational leave: 0,7	0,7
I3	Common demands on extended vacation: 1	1
I4	Common measures on extended vacation: 1	1
I5	LO/NHO: 0,25, LO/HSH: 0,5, LO, YS, AF, A and NL/state: 0,5, Pilice, Nito and NFF/state: 0,5, LO, YS, AF and A/KS: 0,5, NL and FO/KS: 0,25, DNMF/KS: 0 Coordinated settlement: (0,25+0,5+((0,5+0,5+0,5+0,25+0)/5)=1,1/3=0,37	0,37
	Sum	3,82

(NOU 2001:17: s.113-140)

2001

The central additions for 2001 were determined in wage negotiations in 2000, and it was therefore not conducted central negotiations in 2001. Local negotiations were conducted within the limits set by the wage settlement in 2000. LO, YS, AF and Academics were represented as unions in TBU. NHO, HSH, KS and the state were represented as employer organisations.

2001		Weighted average
I1	Only local negotiations in the private sector: 0, State and municipal: 1 The order of the Aukrust model: 1	0,67
I2	Commission about support for subsistence during educational leave presented findings: 0,7	0,7
I3	Agreeing to keep the agreement from 2000: 1	1
I4	Agreeing to keep the agreement from 2000: 1	1
I5	Agreement in all negotiations: 1	1
	Sum	4,37

(NOU 2001:17: s.113-140)

2002

In 2002 it was main revision for most tariff areas. In the manufacturing sector and the private service sector the settlements were conducted by bargaining on industry level. Pension was a key issue in the negotiations. NAVO, Norwegian Employers' Association for Enterprises with Public Sector Affiliations, was included in the report from TBU. LO, YS, UHO and Academics were represented as unions in TBU. NHO, HSH, KS and the state was represented as employer organizations.

2002		Weighted average
I1	LO/NHO, LO/HSH, YS/NHO, NAVO: 0 State, municipal, NAVO: 1 The order of the Aukrust model: 1	0,67
I2	No additional government contribution: 0,5	0,5
I3	No coordinated demands: 0. Agreeing on proposal from the state: 1. Agreeing with municipality in the first round: (A)/(LO,YS,UH,A): 0,25. Agreeing with municipality in the second round: 1.	0,56
I4	Agreeing to increase the minimum wage: 1	1
I5	FF/TBL: 0,5, Hotel and restaurant: 0,25, NTF/TL: 0,5, YS/TL: 1, LO, YS, A, UHO/state: 1, A/ municipal: 1, LO, YS, UHO/ municipal: 0,5, LO, YS, UHO/NAVO: 0,5, NJ/MBL: 0,25, HK/HSH: 1, (0,5+0,25+0,5+1+1+1+0,5+0,5+0,25+1)/10= 0,65	0,65
	Sum	3,82

(NOU2003:10, s.90-94)

2003

On most tariff areas there were signed two-year agreements in 2002 with provisions that gave access to negotiations of any salary adjustments at regular revision time in 2003. There were given no or moderate central additions to the settlement in 2003 in all major bargaining areas (NOU 2004: 10, s .98). The reason for this was the high wage growth in 2002. Negotiations were conducted coordinated with industry-level customizations. LO, YS, UHO and Academics were represented as unions in TBU. NHO, HSH, KS, the state and NAVO were represented as employer organizations. TBU was by Royal Decree of 5 December 2003 reappointed for a second term until September 30th 2007.

2003		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH: 1 State, municipal, NAVO: 1 The order of the Aukrust model: 1	1
I2	Established two commissions as a result of high wage growth in 2002: The Holden II Commission and a dialogue forum under the Contact Committee (Kontaktutvalget): 1. Letter from the Prime Minister to LO, YS and NHO about the wage growth: 1. Labour market measures to prevent increased unemployment: 1 Promised to consider legislative amendment on pension: 1	1
I3	Agreeing on work on pension schemes: 1 Agreeing to avoid salary adjustment in state and municipal: 1	1
I4	Agreeing in the Contact Committee that the wage trend with our trading partners must form the basis for wages: 1	1
I5	LO/NHO: 0,5, LO,YS,UHO, A/state: 1, LO,YS,UHO/KS: 1, YS/NHO: 0,5, LO/HSH: 1, YS/HSH: 1, LO, YS, UHO/NAVO: 1. Coordinated settlement: (0,5+1+(3,5/4))/3= 0,79	0,79
	Sum	4,79

(NOU 2004:10, s.98-105)

2004

In 2004 it was main revision for most tariff areas. New this year was an extended Aukrust model where the workshop agreement (Verkstedsoverenkomsten), the agreement between Norwegian Industry and FF (Teko-overenskomsten) and the agreement for the construction industry negotiated simultaneously. In the manufacturing sector and the private service sector the settlements were conducted by bargaining on industry level. Pension was a major issue in 2004. LO, YS, UHO and Academics were represented as unions in TBU. NHO, HSH, KS, the state and NAVO were represented as employer organisations.

2004		Weighted average
I1	LO/NHO, LO/HSH, YS/NHO, NAVO: 0 State, municipal, NAVO: 1 The order of the Aukrust model: 1	0,67
I2	Letters on pension and monitoring of the Pension Commission: 0,7	0,7
I3	Agreeing on demands for equal pay, pensions and temporary work: 1. Agreeing with the government on new deal: 1	1
I4	Agreeing on competitiveness: 1	1
I5	FF/TBL: 0,5, Hotel and restaurant: 0,25, NTF/TL: 0,5, YS/TL: 1, NSU/RL: 1, DNMF /RL: 0,5, YTF, NTF/TBL: 1, HK/HSH: 1, NTF,YTF,PRIFO/HSH: 0,25, Farmasif,NFF/HSH: 1, LO, YS, A, UHO/state: 0,5, LO, YS, A, UHO/KS: 0,5, LO, YS, UHO/NAVO: 0,5, NJ/MBL: 0,25, NGF/Viskom: 0,25, NNN/NBL: 0,5 FF/Norwegian armed forces: 0,5, OFS/OLF, NSA: 0, EL IT/TELFO: 0.	0,5
	Sum	3,87

(NOU 2005:7. s.107-115)

2005

In most areas there were signed two-year Collective agreements in 2004 with access to negotiate wage adjustments in 2005. Negotiations were conducted coordinated with industry-level customizations. For some groups wage adjustments for 2005 were agreed upon in the settlements in 2004. This included the KS area and the health authorities. Pension was a major issue in 2005. LO, YS, UHO and Academics were represented as unions in TBU. NHO, HSH, KS, the state and NAVO were represented as employer organisations.

2005		Weighted average
I1	LO/NHO, LO/HSH, YS/NHO: 1 State, municipal, NAVO: 1 The order of the Aukrust model: 1	1
I2	No additional government contribution: 0,5	0,5
I3	Agreeing on pay equity measures and pension: 1. Agreeing on offer from the state:(LO,YS,UHO)/(LO,YS,UHO,A)=0,75	0,88
I4	Agreeing to strengthen competitiveness: 1	1
I5	LO/NHO: 1, LO, YS, UHO/state: 1, A/state: 0,5, LO, YS, UHO, A/KS: 1, YS/NHO: 1, LO/HSH: 1, YS/HSH: 1, LO, YS, UHO/NAVO: 1, Coordinated settlement: (1+(2,5/3)+1)/3= 0,94	0,94
	Sum	4,32

(NOU 2006:11, s.102-105)

2006

In 2006 it was time for main revision for most tariff areas. Pension was a major issue also in 2005, with a particular focus on AFP. In the manufacturing sector and the private service sector the settlements were conducted by bargaining on industry level. Higher Education Association, UHO, changed its name to Unio. LO, YS, Unio and Academics were represented as unions in TBU. NHO, HSH, KS, the state and NAVO were represented as employer organizations.

2006		Weighted average
I1	LO/NHO, LO/HSH, YS/NHO, NAVO: 0 State, municipal, NAVO: 1 The order of the Aukrust model: 1	0,67
I2	Letters on AFP and process for the new social security scheme(Folketrygd) in 2010: 0,7	0,7
I3	Agreeing on no change in AFP: 1. Agreeing with the state on new agreement: (LO,YS,Unio)/(LO,YS,Unio,A)=0,75	0,75
I4	Agreeing on competitiveness: 1. Agreeing on increased possibilities for local adaptation: (NHO,HSH,NAVO)/(NHO,HSH,KS,staten,NAVO)= 0,6	0,8
I5	FF/TBL: 0,5, FF/BNL: 0,25, Hotell and restaurant: 1, NSU/RL: 0,5, NSOF/RL: 0,5, YTF/TBL: 0,5, NTF/TBL: 1, DNMF/RL: 0,5, HK/HSH: 1, YTF,Parat/HSH: 1, Bank and insurance: 0, HUK/HSH: 0,5, A/stat: 0, LO, YS, Unio/stat: 0,5, NJ/NAVO:0,25 LO, YS, A, UHO/KS: 0,5, EL IT/Telenor, Abelia: 0,25, Orchestras and theaters: 0,25, 9/18= 0,5	0,5
	Sum	3,53

(NOU 2007:3, s.103-112)

2007

It was intermediate settlement adjusting wage rates from 2006. Negotiations were conducted coordinated with industry-level customizations. Equal pay and competitiveness were key issues. Employers' Association NAVO changed its name to Spekter on June 6th 2007. LO, YS, Unio and Academics were represented as unions in TBU. NHO, HSH, KS, the state and Spekter were represented as employer organizations. TBU was reappointed by Royal Decree of November 16th 2007 for a further period until September 30th 2011.

2007		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH, Spekter: 1 State, municipal, Spekter: 1 The order of the Aukrust model: 1	1
I2	No additional government contribution: 0,5	0,5
I3	Agreeing on pay equity measures: 1. Agreeing on offer from Oslo municipality: (LO,YS,Unio)/(LO,YS,Unio,A)= 0,75	0,88
I4	Agreeing to strengthen competitiveness: 1	1
I5	LO/NHO: 0,5, LO,YS,Unio,A/staten: 1, LO,YS,Unio,A/KS: 1, YS/NHO: 0,5, A/Oslo municipality: 0,5, YS/HSH: 1, HUK area: 1, LO,YS,UHO/Spekter: 1, LO/HSH: 1, A/Spekter: 0,5. Coordinated settlement: (0,5+1+(5,5/7))/3= 0,76	0,76
	Sum	4,15

(NOU 2008:10, s.103-108)

2008

In 2008 it was main revision for most tariff areas, but negotiations were conducted coordinated with industry-level customizations. AFP and the gradual introduction of age adjustment in the new national social security scheme were key issues in the negotiations. LO, YS, Unio and Academics were represented as unions in TBU. NHO, HSH, KS, the state and Spekter were represented as employer organisations.

2008		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH, Spekter: 1 State, municipal, Spekter: 1 The order of the Aukrust model: 1	1
I2	Letter on AFP and the Government's economic contribution to the scheme: 0,7	0,7
I3	Agreeing on demands to new AFP-scheme: 1	1
I4	Agreeing on demands to new AFP scheme: 1. Agreeing on increased possibilities for local adaptation: (NHO,HSH,Spekter)/(NHO,HSH,KS,staten,Spekter)= 0,6	0,8
I5	LO/NHO: 0,5,LO,YS,Unio,A/state: 0,25, LO,YS,A/KS: 0,5, Unio/KS: 0,25, LO/HSH: 1, YS/HSH: 1, KAH, YS, A/Oslo: 0,5, Unio/Oslo: 0,25, A/Spekter: 0,25, YS/NHO: 0,5, LO, YS/Spekter: 1, LO Stat/Spekter: 0,5, NNN/Tine: 0,5, Coordinated settlement: (0,5+0,33+(5,5/9))/3= 0,48	0,48
	Sum	3,98

(NOU 2009:7, s.99-108)

2009

It was intermediate settlements in 2009, adjusting wage rates from 2008. Negotiations were conducted coordinated with industry-level customizations. Parts of the international financial market crashed during the autumn of 2008. The financial crisis was important in the negotiations in 2009. LO, YS, Unio and Academics were represented as unions in TBU. NHO, HSH, KS, the state and Spekter were represented as employer organisations.

2009		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH, Spekter: 1 State, municipal, Spekter: 1 The order of the Aukrust model: 1	1
I2	No additional government contribution: 0,5	0,5
I3	Agreeing on claim for equal pay and focus on low wages: 1	1
I4	Agreeing on requirements for low wage growth due to the financial crisis: 1	1
I5	LO/NHO: 0,5, LO,YS,Unio,A/state: 0,5, YS/NHO: 1, LO,YS,Unio,A/KS: 0,5, LO/HSH: 1, YS/HSH: 1, HUK-omrt: 1, LO, YS, Unio, A/Spekter: 1, Norsk Flygerforbund/NHO: 0. Coordinated settlement: (0,5+0,5+(5/6))/3= 0,61	0,61
	Sum	3,98

(NOU 2010:4, s.98-104)

2010

In 2010 it was main revision for most tariff areas. In the manufacturing sector and the private service sector the settlements were conducted by bargaining on industry level. LO, YS, Unio and Academics were represented as unions in TBU. NHO, HSH, KS, the state and Spekter were represented as employer organisations.

2010		Weighted average
I1	LO/NHO, LO/HSH, YS/NHO, Spekter: 0 State, municipal, Spekter: 1 The order of the Aukrust model: 1	0,67
I2	Letter with initiative to establish programs that promote a serious and well-functioning labor market in particularly vulnerable sectors: 0,7	0,7
I3	Agreeing on the importance of adhering to the Aukrust model due to the financial crisis, and on equal pay: 1. Agreeing to reduce the use of part-time workers: (LO,YS,Unio)/(LO,YS,Unio,A)= 0,75	0,86
I4	Agreeing on competitiveness and equal pay: 1. Agreeing on increased possibilities for local adaptation: (NHO,HSH,Spekter)/(NHO,HSH,KS,staten,Spekter)= 0,6	0,8
I5	FF/Norwegian industri: 0,5, FF/BNL: 0,25, NTF/TBL: 0,5, Hotel and restaurant: 0,5, NTF/LTL: 0,25, NSU/RL: 0,5, DNMF/RL: 0,5, YTF/TBL: 0,5, HK/HSH: 1, N.TF/HSH: 1, YTF,Parat/HSH: 1, Parat,Negotia/HSH: 1, HUK-omrt: 1, Banking: 1, LO,YS,Unio,A/stat: 0,5, Unio/Spekter: 0,25, LO,YS,A,Unio/KS: 0,25, LO,YS,A,Unio/Oslo: 0,5, NAF/NHO: 0,5, YS/Spekter and health authorities: 0, LO,YS/Spekter: 1. 12,5/21=0,6	0,6
	Sum	3,59

(NOU 2011:5, s.108-117)

2011

The 2011 wage settlement involved a revision of the wage rates in the 2010-2012 collective agreements. Negotiations were conducted coordinated with industry-level customizations. Employer Organization HSH changed its name to Virke. Competitiveness and equal pay was important questions. LO, YS, Unio and Academics were represented as unions in TBU. NHO, Virke, KS, the state and Spekter were represented as employer organisations. ne Cappelen from Statistics Norway took over as chairman of the committee. TBU was reappointed till 2015.

2011		Weighted average
I1	LO/NHO, YS/NHO, LO/HSH, Spekter:1 State, municipal, Spekter: 1 The order of the Aukrust model: 1	1
I2	No additional government contribution: 0,5	0,5
I3	Agreeing on demand for equal pay, and focus on low wages: 1	1
I4	Agreeing on competitiveness and equal pay: 1.	1
I5	LO/NHO: 1, LO,YS,Unio,A/state: 1, LO,YS,Unio,A/KS: 1, LO,YS,Unio,A/Oslo: 0,5, YS/NHO: 1, LO/Virke: 1, YS/Virke: 1, Agreement for special health care: 0,5, Bank and insurance: 0,5, LO, YS, Unio, A/Spekter: 1, NISO/NHO: 0,5, HUK area: 1, Coordinated settlement: (1+1+(7/9))/3= 0,93	0,93
	Sum	4,43

(NOU 2012:11, s.9106-111)

2012

In 2012 it was main revision for most tariff areas. In the manufacturing sector and the private service sector the settlements were conducted by bargaining on industry level. Paternity leave was an important issue in the negotiations. LO, YS, Unio and Academics were represented as unions in TBU. NHO, Virke, KS, the state and Spekter were represented as employer organisations.

2012		Weighted average
I1	LO/NHO, LO/HSH, YS/NHO, Spekter: 0 State, municipal, Spekter: 1 The order of the Aukrust model: 1	0,67
I2	No additional government contribution: 0,5	0,5
I3	Agreeing on demand for equal pay and higher real wages: 1	1
I4	Agreeing on competitiveness, equal pay and paternity leave:1	1
I5	FF/Norwegian industri: 0,5, Hotel and restaurant: 0,5, FF/BNL: 0,5, NAF/NHO: 0, NTF/NHO: 0,5, YTF,YS,LO state/NHO,Spekter,Virke on buss drivers: 1, HK/Virke: 1, Parat,Negotia/Virke: 1, HUK area: 1, Bank and insurance: 1, A/state: 0,5, LO,YS/state: 0,25, Unio/state: 0, LO,YS,A,Unio/KS: 0,25, A,Fagf./Oslo: 0,5, LO,YS/Spekter: 1, SAFE/Norwegian oil and gas: 0,5, Fagforbundet/ NHO on nurses: 0, Industri Energi, Lederne/Norwegian oil and gas: 0, LO,YS/Oslo: 0,25. 10,25/20=0,51	0,51
	Sum	3,43

(NOU 2013:7, s.101-111)